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REPORT ON THE PYCNOGONIDA COLLECTED BY THE ALBATROSS IN JAPANESE WATERS IN 1900 AND 1906

BY

JOEL W. HEDGPETH

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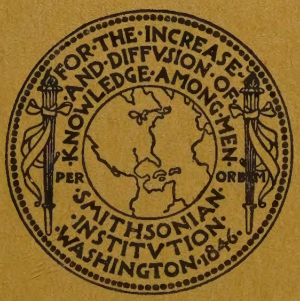

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REPORT ON THE PYCNOGONIDA COLLECTED BY THE ALBATROSS IN JAPANESE WATERS IN 1900 AND 1906

By Joel W. Hedgpeth

In the 42 years since the *Albatross* investigated Japanese home waters, no extensive report on the Pycnogonida of Japan or of the northwestern Pacific has appeared, with the single exception of Losina-Losinsky's paper (1933) on collections made by various Russian expeditions in the Bering, Okhotsk, and Japanese Seas. Hence, in spite of their age, the collections of the *Albatross* provide the occasion for the first major systematic report on Japanese pycnogonids, or at least of those species occurring in offshore waters, as the bulk of the collections were made by dredging.

The littoral species have evidently been extensively collected by Japanese workers, but with the exception of some short papers by Ohshima relatively little systematic work has been published on the littoral species of the Japanese coasts. The *Albatross* collections shed little light on the littoral fauna, although two previously unreported species were collected by shore parties at Hakodate and on Shimushiru. Other littoral species collected by later visitors to Japan have been included in this collection. Undoubtedly the Japanese have also undertaken expeditions in their home waters, but no reports of pycnogonids collected have come to notice, and it has remained for this long-delayed study of collections made more than 40 years ago to reveal the rich character of the fauna occurring in moderate depths around the Japanese islands.

It has long been known that the genus *Ascorhynchus* is extraordinarily well represented in Japanese waters, with 6 well-established

species identified from the region. Several other genera are equally well represented in the *Albatross* collections, which include 7 species of *Colossendeis* and 4 species of *Pallenopsis*. Two genera that might be expected to have larger representations, *Anoplodactylus* and *Achelia*, are predominantly littoral, and it is probable that study of existing and future shore collections will reveal several more species of both these genera. There is but one well-established species of *Anoplodactylus*, and there appear to be 2 more species, known from females or immature forms, and there are 7 or 8 species of *Achelia*. There are at least 14 species of this latter genus on the Pacific coast of North America. The genus *Tanystylum* is represented by one previously undescribed species, which is evidently rare, whereas there are two species on the California coast that are common within their known ranges. However, species of *Tanystylum* are very small and may have been overlooked. The dredge collections reveal a bewildering array of species of the topheavy genus *Nymphon*, increasing the number of species known from Japanese waters to 16 or 17, several of which are apparently undescribed. It is with reluctance that I propose 9 new species for this genus, but there seems to be no help for it. *Nymphon striatum*, described from Vladivostok and the western edge of the Japanese Sea, is not represented in the *Albatross* collections, and apparently has a restricted range.

In table 1 the distribution of all species mentioned as occurring in Japanese or adjacent waters (from Kamchatka to Okinawa), including the Sea of Okhotsk, is tabulated. An asterisk indicates those species represented in the *Albatross* and other National Museum collections and considered in the systematic section of this report.

I am indebted to Dr. Waldo L. Schmitt, head curator, Department of Zoology, of the United States National Museum, for the privilege of examining these collections and for help with the literature and many other details, without which it would have been impossible to complete this paper.

ZOOGEOGRAPHICAL REMARKS

The general location of the Japanese Archipelago in relation to the physical geography of the North Pacific invites comparison with the eastern coast of North America (cf. Ekman 1935, p. 230 ff., and Sverdrup, Johnson, and Fleming, 1942, pp. 718–723). Like that region, Japan lies between a Boreal Arctic and a tropical zone, and its marine fauna is an intermingling of cold- and warm-water species. Like the eastern coast of North America, it is warmed by a northward flowing current which veers eastward (at lat. 35° N. in the Pacific, instead of 40° N., as in the Atlantic), but unlike that region Japan is completely surrounded by water and is the border of a closed inland sea. Another important difference between the Japanese coast and that of eastern

TABLE 1.—*Distribution of Pycnogonida found in Japanese waters and the North Pacific*

Species	Cosmopolitan deep-water species	East Indies	East coast Japan to 35° N.	West coast Japan, Japanese Sea	East coast, N. of 35°, to Sea of Okhotsk	Bering Sea, Alaska	Arctic-Circumpolar	California	Bathymetric range (North Pacific)
NYMPHONIDAE:									
Nymphon grossipes (O. Fabr.?) (Krøyer)				×	×	×	×		Fathoms 24–150
longitarse Krøyer*				×	×	×	×		52–428
brevirostre Hodge						×	×		3–37
macrum Wilson			?						?
micronyx Sars?						×			?
japonicum Ortmann*			×	×					34–548
braschnikowi Schimkewitsch*					×				52–349
hodgsoni Schimkewitsch*				×	×				52–100
striatum Losinsky				×					.5–35
elongatum Hilton*				×	×	×			72–130
kodanii, new species*			×						120–649
micropedes, new species*			×						505
benthos, new species*			×						622
guntert, new species*					×				266
heterospinum, new species*					×				266
dissimilis, new species*					×				1,046
uniunguiculatum Losinsky*				×					300–428
albatrossi, new species*				×					82–440
ohshimai, new species*			×						545–712
nipponense, new species*					×				244–712
PALLENIDAE:									
Callipallene amaxana (Ohshima)				×[a]					
dubiosa, new species*					×				Shore
Propallene longiceps (Böhm)			×	×[a]					Surface, shallow
Pallenopsis mollissima (Hoek)*		×	×						505–1875
tydemani Loman*		×	×						434
virgatus Loman*		×	×						34–37
stylirostre, new species*			×						500–649
Decachela discata Hilton*				×				×	59
PHOXICHILIDIIDAE:									
Phoxichilidium ungellatum, new species*			×	×	×				82–600
horribilis, new species*					×				229
Anoplodactylus gestiens (Ortmann)*			×						31–68
sp. Ohshima				×					Shore
sp.*			×						22–514
Halosoma derjugini Losinsky				×					2
Pycnosoma strongylocentroti Losinsky				×		×			2–40
AMMOTHEIDAE:									
Achelia echinata Hodge				×					Shore
sp. Ohshima			×						Shore
sp.*					×				Shore
alaskensis (Cole)					×	×			Shore
pribilofensis (Cole)*					×	×			Shore
borealis (Schimkewitsch)*					×				174–349
superba (Loman)*			×		×				40–73
bituberculata, new species*			×						Shore
Ammothella bi-unguiculata (Dohrn)			×						Shore
profunda, new species*			×						624

See footnotes at end of table.

TABLE 1.—*Distribution of Pycnogonida found in Japanese waters and the North Pacific*—Continued

Species	Cosmopolitan deep-water species	East Indies	East coast Japan to 35° N.	West coast Japan, Japanese Sea	East coast, N. of 35°, to Sea of Okhotsk	Bering Sea, Alaska	Arctic-Circumpolar	California	Bathymetric range (North Pacific)
AMMOTHEIDAE—Continued									*Fathoms*
Ascorhynchus auchenicus (Slater)*		×	×						25–100
ramipes (Böhm)*			×	×					50–150
japonicus Ives*			×		×				88–918
cryptopygius Ortmann			×						60–150
glabroides Ortmann*				×					40–139
glaberrimus Schimkewitsch*				×					?
Nymphonella tapetis Ohshima				×					Shore
Nymphopsis muscosa Loman		×							20–50
Cilunculus armatus (Böhm)*			×		×				36–349
Lecythorhynchus hilgendorfi (Böhm)*			×	×	×				Shore–37
marginatus Cole				×				×	Shore
sp.*				×					34–37
Endeis mollis (Carpenter)			×						Shore
TANYSTYLIDAE:									
Tanystylum anthomasthi, new species					×				----------
COLOSSENDEIDAE:									
Colossendeis angusta Sars*	×		×		×				266–624
colossea Wilson*	×	×	×						662–905
macerrima Wilson*	×	×	×						624
japonica Hoek*			×	×					391–875
dofleini Loman*			×		×				229–426
chitinosa Hilton*			×	×		×			31–428
nasuta, new species*				×					391
PYCNOGONIDAE:									
Pycnogonum tenue Slater*			×	×					34–152
stearnsi Ives					×	×		×	Shore
ungellatum Loman*			×						229
benokianum Ohshima			×						Shore
buticulosum, new species*					×				Shore

*Species represented in the *Albatross* and other U. S. National Museum collections.
• Surface tow records.

North America is the rugged, indented character of the former. Such a coast is favorable to a greater variety of littoral species and it is probable that there may actually be twice as many littoral species in this region as are now recognized.

Because there is no adequate channel opening into the Pacific at the north to permit the exchange of water between it and the Pacific, the Japanese Sea is virtually a closed system, based on the diversion of the warm southern current south of Kyushu, which turns upon itself in the northern reaches of the Japanese Sea and flows southward along the Siberian coast as a cool current. Like other similarly enclosed seas, the Japanese Sea has a fauna with endemic species as well as forms which have migrated through the channels into it. North of the Sea

of Japan lies the Sea of Okhotsk, separated from the Pacific by the picket fence of the Kurile chain, with a fauna even more derivative than that of the Sea of Japan. Unfortunately, these interesting regions are still inadequately known, and much of the work that has been done has been published in Russian and Japanese, and many papers are inaccessible to American workers.

The meeting ground of tropical and Boreal Arctic species occurs on the eastern coast of Japan at about latitude 35° N., where the warm water Kuroshio turns eastward and the cold Oyashio from Kamchatka and the Kuriles reaches its southern limit. As might be expected, this hydrographic phenomenon is reflected in the limitation of East Indian species to regions south of 35° and the restriction of most Boreal Arctic species to the north of that latitude. The most conspicuous example of this is to be found in the genus *Pallenopsis*, a predominantly warm-water genus. Four species are known in Japanese waters. Three of these, *Pallenopsis mollissima*, *tydemani*, and *virgatus*, occur in the East Indies, and the fourth, *P. stylirostre*, is known only from Japanese waters. None of them have been collected north of 35°, and it is probable that *P. stylirostre* will be found in more southern waters. It should be noted, however, that it appears more common for Boreal Arctic species to work south into slightly warmer regions than it is for tropical species to work north, a situation also apparent on the eastern coast of North America, where *Nymphon grossipes* and *Pycnogonum littorale* are found south of Cape Cod, but *Endeis spinosa* and *Anoplodactylus lentus* are unknown north of that dividing point.

In spite of the exposed position of the eastern coast of Japan, there appear to be relatively few of those widely distributed species that are known to occur throughout most of the northern oceans. Only *Nymphon longitarse* and probably *N. grossipes*, of the Boreal Arctic species, occur in Japanese waters proper, i. e., near the shore between latitude 30° N. and 45° N., and are most often reported from the Japanese Sea rather than from the outer coast. A few of the endemic species, notably *Ascorhynchus japonicus* and *Cilunculus armatus*, are found along the shore both north and south of 35°, but on the whole species do not cross this boundary, if the collections at hand can be assumed to reflect the actual distribution of pycnogonids in Japanese waters.

Three species are common to Japanese waters and the coast of California: *Decachela discata*, *Lecythorhynchus marginatus*, and *Pycnogonum stearnsi*. Of these species, *Lecythorhynchus marginatus* is reported from the Sea of Okhotsk and *Pycnogonum stearnsi* has been identified from the northern Kuriles. Hence only *Decachela discata*, from station 4987, off the western coast of Hokkaido near latitude 43° N., can be considered to occur near Japan proper. A fourth

species known from both the Japanese and California coasts, *Ammothella bi-unguiculata*, is also known from Naples, Hawaii, and Western Australia, and it appears to be that *rara avis* among the Pycnogonida, a cosmopolitan littoral species. This species is obviously a warm-water form, for on the California coast it does not occur north of Point Concepcion, and in Japan it has not been recorded north of latitude 35°. Still another species, *Achelia echinata*, may be cosmopolitan, but it will be necessary to examine comparative material from the various parts of the world in which forms ascribed to this species have been identified before it is possible to confirm this distribution. *Achelia echinata*, or its varieties, has been identified from China (Kiaochow), Japan, Alaska, San Francisco Bay, Europe (Norway, France, England, and Italy) and some authors have suggested that the New England *Achelia spinosa* is also synonymous with this species. As a rule, however, species common to both sides of the Pacific are cold-water forms, which are apparently dispersed from the north (fig. 18).

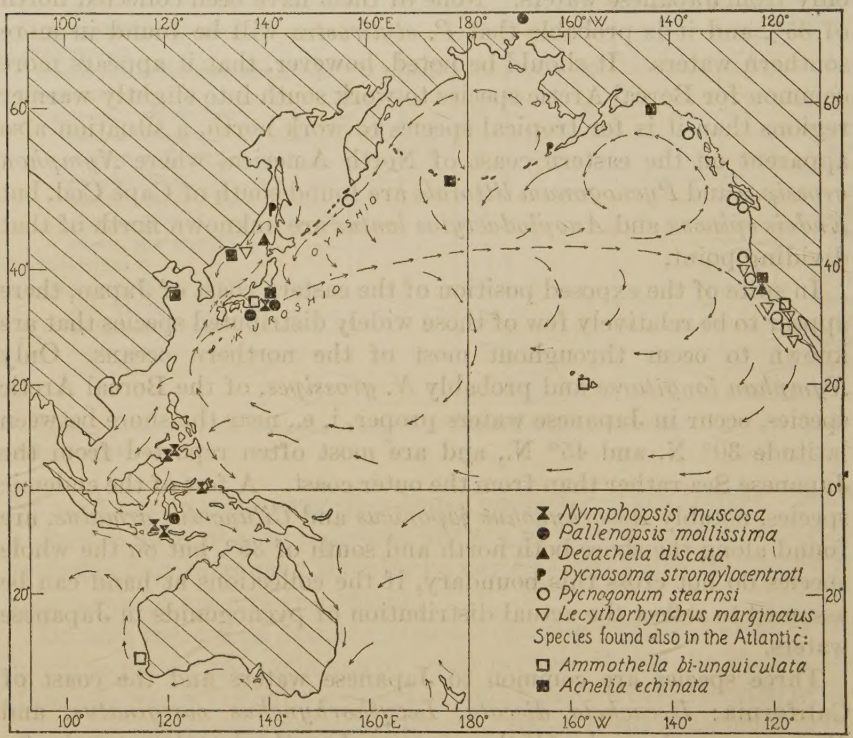

FIGURE 18.—Distribution of various species of pycnogonids in the North Pacific (compiled from various sources).

Evidently the Kuroshio has less effect on the distribution of these animals than the Gulf Stream has in the North Atlantic, and several

East Indian genera found in Japanese waters, such as *Pallenopsis* and *Ascorhynchus*, are rarely reported from California waters. This difference in the distributional effect of the Pacific and Atlantic currents is due primarily to the absence of large rafts of sargassum in the Pacific, which provide a convenient agency for the distribution of small forms in the North Atlantic (Hedgpeth, 1948, p. 170). This is emphasized by the fact that there are no species of *Endeis* or *Anoplodactylus* common to both shores of the North Pacific, as is the case in the North Atlantic, although there are several species that have been collected in tow nets in Japanese waters (Ohshima, 1933c), and which might be expected to have a wider distribution because of this pelagic habit.

There appears to be a characteristic pycnogonid fauna in the Bering Sea, including a northern species of *Pallenopsis* not known elsewhere, one or two species of *Pseudopallene*, and several endemic Nymphons. Some of the Nymphons and Achelias from the Bering Sea are found also along the northern Japanese coast and probably in the Japanese Sea, and it seems likely that they represent dispersals from this cold water area via the Oyashio. The interesting *Pycnosoma strongylocentroti* is probably such a species, since it has been found in the Gulf of Tatary and off Unalaska (the specimen from the latter locality was described by Hilton, 1942c, p. 40, under the name *Pigrogromitus robustus*).

Although these generalizations are based solely on the distribution of pycnogonids, they confirm the character of the Japanese marine fauna as outlined by Ekman (1935, pp. 39–43). His conclusion that the North Pacific littoral fauna (ibid., p. 231) is six to eight times richer than the North Atlantic holds true (although in lesser degree) for the pycnogonids, as it does for the decapods, sea stars, and fishes on which it was based. All the genera containing littoral species in the North Atlantic are represented in the North Pacific, several of them with many more species than in the Atlantic, and in addition there are at least three genera, *Nymphonella*, *Decachela*, and *Lecythorhynchus*, endemic to the North Pacific. Indeed, there is but one authentic endemic genus in the North Atlantic, *Paranymphon*, and its only species is a deep-water form. It must be understood that these remarks do not hold true if the Caribbean region is included in the North Atlantic, for insofar as present knowledge of the pycnogonid fauna of comparable regions is concerned, the Caribbean appears to be somewhat richer than the East Indies in number of genera and species. These remarks, then, apply to the North Atlantic north of Florida and Cape Verde and the Pacific from Japan northward on the west and the California coast on the east.

Recently Gislén (1943, 1944) has published detailed comparisons of the coasts of California and Japan at comparable latitudes. The most

conspicuous difference between the littoral regions is the warmer summer of Japan, accompanied by a tidal exposure occurring at a more unfavorable time of day. The cooler, overcast summers of the California coast offer less severe conditions of exposure to many marine animals, although the greater wave shock of the California coast confines many species to more sheltered locations. This combination of factors is evidently more favorable to littoral or intertidal pycnogonids than are the circumstances prevailing on the Japanese coasts, to judge from the number of species known at present

This is in substantial agreement with Gislén's summary statement (1944, p. 81) that "on the whole, however, shorewater life has much better possibilities in California than in Japan," although it is more stenothermic on the California coast. Since it appears that most pycnogonids are stenothermic, it is not surprising that there are so many more intertidal or shallow water-forms known on the California coast, although there is, according to Gislén, a greater number of species on the Japanese coast in certain other groups.

THE GENUS NYMPHON

A much better view of the distribution of pycnogonids in the regions under consideration can be had from an examination of the genus *Nymphon*, which comprises nearly 80 percent of the collections made by the *Albatross* and perhaps about 30 percent of the species occurring in the North Pacific. Although a few of the identifications, such as *Nymphon micronyx* from Africa Cape, Kamchatka, and *N. macrum* from Sagami Bay, may be open to question, the general distribution picture, as illustrated in figure 19, can be relied upon. It is possible that the species identified by Ohshima (1936) as *Nymphon macrum* may actually be a specimen of *Nymphon japonicum*, and it seems best to ignore this identification until it is supported by more material or adequate figures.

There are, then, at least 15 species of *Nymphon* present in Japanese and adjacent waters. Some of these are comparatively abundant, and none of them may be rare, although several are so far known only from single specimens. No other genus is so abundantly represented, insofar as actual numbers of specimens (or "species-mass") is concerned. This is in sharp contrast to the Atlantic coast of North America, where such species as *Tanystylum orbiculare* and *Anoplodactylus lentus* are often collected in lots of 50 or more. Of course, it is possible that some littoral species are as abundant on the Japanese coast, but on the whole the picture seems to be that of widely distributed species in small numbers, except for the genus *Nymphon*.

As can be seen from the distribution map (fig. 19), the Japanese Sea derives most of its species from cold-water regions, but at least

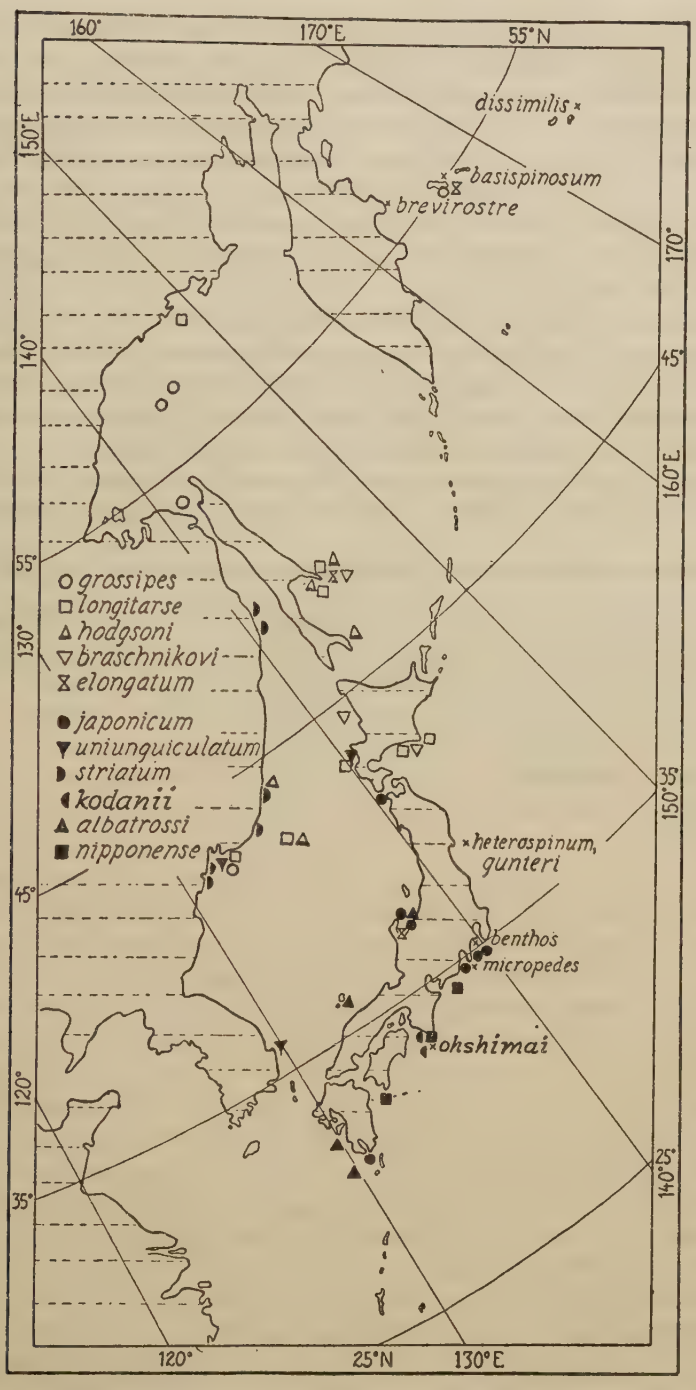

FIGURE 19.—Distribution of species of *Nymphon* in the Northwestern Pacific.

two, *Nymphon nipponense* and *japonicum*, have apparently found their way in from the south. Migrations from the north are represented by such species as *grossipes*, *longitarse*, and *hodgsoni*. Two species, *uniunguiculatum* and *striatum*, are apparently endemic. Some of the species found off southern Japan (along the east coast south of lat. 35° N.), such as *japonicum*, *albatrossi*, and *nipponense*, may also occur in the Philippines or East Indies, although no tropical species of *Nymphon* is represented in collections so far reported upon from Japanese waters.

An interesting feature of the species of *Nymphon* from Japanese waters is the relatively high percentage of uniunguiculate forms. Of the 15 species certainly occurring in Japanese waters, four are without auxiliary claws, and there are at least five such species in the North Pacific. This is in sharp contrast to the North Atlantic, in which there are no known species, except the somewhat anomalous *Boreonymphon robustum*, without auxiliary claws. Another interesting

TABLE 2.—*Ovigeral spines of various North Pacific species of* Nymphon

Species	Fine-toothed spines	Coarse-toothed spines (B: coarse basal spines)	North of 35°	South of 35°	East of 180°	West of 180°
WITH AUXILIARY CLAWS						
grossipes	×	B	×		×	×
longitarse	×	B	×		×	×
brevirostre	×	B	×		×	×
macrum	×			?	?	
micronyx	×	B	×		×	
japonicum		×		×	×	
braschnikowi		×	×		×	
hodgsoni		×	×		×	
pixellae	×	B	×			×
striatum	×				×	
molum		×	×			×
variatum			×			×
basispinosum	×		×		×	
elongatum	×	B	×		×	×
microsetosum	×		×		×	
duospinum	×		×			×
orientale		×		×	×	
micropedes		×		×	×	
benthos		×		×	×	
gunteri	×	B	×		×	
heterospinum	×	B	×		×	
dissimilis	×			×	×	
WITHOUT AUXILIARY CLAWS						
uniunguiculatum	×		×	×	×	
profundum		×	×			×
albatrossi	×	×		×	×	
ohshimai		×		×	×	
nipponense		×		×	×	

detail is the high number of species in which the compound spines of the oviger bear but two or three pairs of coarse teeth instead of numerous pairs of fine teeth. This characteristic is also of rare occurrence in the North Atlantic, although a Florida species has completely smooth ovigeral spines and a species found on the Grand Banks has spines with two or three pairs of teeth.

This is evidently correlated with temperature, or salinity, or perhaps both, as the tabulation (table 2) indicates a close agreement with the significant latitude of 35° in the North Pacific. Such correlation is not evident among North Atlantic species, but it is impossible to tabulate them since the conformation of the ovigeral spines is not described for several west African species. Fage (1942, p. 89) suggests a southern origin for the three west African species of *Nymphon* without auxiliary claws. Unfortunately, he did not describe the denticulation of the ovigeral spines for his two new species of uniunguiculate Nymphons.

STATISTICAL COMMENTS ON THE ALBATROSS COLLECTION OF 1906

The *Albatross* occupied 295 stations (4801–5095) in Japanese waters from June to October 1906, at 59 of which pycnogonids were collected. In other words, pycnogonids were collected at about 20 percent of the stations occupied. The depth of these 59 stations ranged from 22 to 918 fathoms, and the average depth was about 325 fathoms. Only two stations, however, were actually near the average depth, and neither can be considered "average" or typical. Most of the stations were in less than 600 fathoms, and only two were in depths of more than 900 fathoms.

More than 375 specimens were taken, representing 11 genera and 36 species, but more than 295 specimens belong to the genus *Nymphon*, and 150 of those are a single species, *Nymphon braschnikowi*. Twenty-six stations are represented by single specimens, and at only 13 stations were more than one species taken. The average number of species per station is 1.6.

Such statistics as these are primarily of value in indicating the relative abundance of various elements in the marine fauna, but comprehensive tabulations are rare except for ecological summaries in connection with limited areas. In such studies the Pycnogonida have usually been overlooked or ignored. However, it would seem that the relative abundance of pycnogonids in the North Pacific is comparable with that in other regions, and the figure of positive hauls in 20 percent of the stations is about what is to be expected in northern waters at least.

Few collecting expeditions are comparable with the 1906 expedition of the *Albatross* in limited area and short time of collecting. Such expeditions as the *Challenger* and *Valdivia* covered vast areas

of the ocean, and the work of the *Albatross* in the North Atlantic was carried out over several years. The most nearly comparable expedition is that of the *Siboga* in the East Indies, which occupied 323 stations between March 1899 and February 1900. Thirty-seven species, representing 17 genera, of pycnogonids were collected at 40 of these stations, and the total number of specimens collected was slightly more than 200. Thus pycnogonids were taken at 12.4 percent of the stations occupied, and the average number of species per station was slightly less than one. If, however, we discard the phenomenal haul of 80 specimens of *Rhopalorhynchus krøyeri* at station 50, the contrast between hauls in the tropics and in colder waters becomes more apparent. As can be seen from a comparison of tables 3 and 4, there are usually fewer individuals taken in warm water, and the hauls usually contain a greater variety of species. Although less rich in genera and species, the northern fauna is more abundant in individuals, as is true of most elements in the marine fauna.

TABLE 3.—*Statistical tabulation of pycnogonids collected by the* Albatross, *1906*

Station	Depth	Number of specimens	Number of species	Station	Depth	Number of specimens	Number of species
	Fathoms				*Fathoms*		
4780 [1]	1,046	1	1	4973	600	1	1
4803	229	3	3	4974	905	1	1
4804	229	4	2	4975	545–712	6	5
4809	207–290	1	1	4977	544	3	2
4822	130	1	1	4980	507	14	3
4826	114	26	2	4982	390–428	5	3
4829	527–548	1	1	4987	59	1	1
4833	79	1	1	5018	100	7	1
4842	82	8	2	5020	73	4	2
4854	335	1	1	5021	73	16	4
4891	181	1	1	5023	75	20	3
4893	95–106	1	1	5024	67	2	2
4895	95	1	1	5025	52	8	3
4900	139	1	1	5026	119	1	1
4908	434	1	1	5029	440	1	1
4909	434	2	1	5032	300	5	1
4912	391	4	2	5037 [2]	175–349	103	4
4913	391	1	1	5038 [3]	175	50	1
4915	427	4	2	5040	140–269	1	1
4919	440	2	1	5043	330	3	1
4933	152	1	1	5050	266	6	3
4934	103–152	20	1	5075	22	1	1
4936	103	1	1	5078	475–514	1	1
4958	405	1	1	5079	475–505	7	3
4960	578	2	1	5080	505	2	2
4965	191	1	1	5082	662	5	2
4967	244–253	1	1	5083	624	5	3
4969	587	3	2	5084	918	3	1
4970	500–649	1	1	5085	622	1	1
4971	649	1	1	5094	88	2	1

[1] Not in Japanese area.
[2] 100 specimens of *Nymphon braschnikowi*.
[3] *Nymphon braschnikowi*.

TABLE 4.—*Statistical tabulation of pycnogonids collected by the* Siboga, *1899–1900*

Station	Depth	Number of specimens	Number of species	Station	Depth	Number of specimens	Number of species
	Meters				*Meters*		
15	100	1	1	184	36	2	2
45	794	4	3	210 a	1,944	1	1
49 a	69	1	1	213	45	2	2
50	27–36	80	1	225 c	0	1	1
60	23	1	1	227	2,081	2	1
65 a	120–400	2	2	240	9–45	+12	1
81	34	2	2	258	22	1	1
88	1,301	2	1	260	90	1	1
94	450	1	1	271	1,788	1	1
99	16–23	6	3	273	13	3	3
117	80	1	1	285	34	1	1
122	1165–1264	7	4	289	112	2	1
129	21–31	1	1	294	73	1	1
136	23	1	1	303	36	2	1
154	59–83	1	1	310	73	6	6
163	29	2	2	314	694	8	2
167	95	1	1	315	36	+15	3
172	18	6	2	316	538	1	1
173	567	8	2	318	88	2	1
178	835	7	2	321	82	2	1

SYSTEMATIC DISCUSSION

Family NYMPHONIDAE Wilson, 1878

Genus NYMPHON J. C. Fabricius, 1794

The taxonomic peculiarities of the Japanese species of this genus have already been commented upon and need not be reviewed here. While the bulk of the collections consists of Nymphons, the representation of some species is disappointingly small. There are no specimens of *Nymphon grossipes* or its manifold varieties, and neither *N. brevirostre* nor *N. micronyx*, which have been recognized from the western Pacific by Russian workers, was taken by the *Albatross* near Japan. Future collections may fill in these gaps.

Nine of the species in the collections are described as new; eight of them are from Japanese waters. Future systematic work may reduce some of these to synonymy, but little comparative material has been available, except the types of Hilton's incompletely described species from the Bering Sea and Alaska. I am not the first, nor will I be the last, to lament over the complexities of this genus, and I earnestly hope that revision of its numerous species will not be too long delayed.

KEY TO SPECIES OF NYMPHON FROM THE NORTH PACIFIC

1. Auxiliary claws present 2
   Auxiliary claws absent 22

KEY TO SPECIES OF NYMPHON FROM THE NORTH PACIFIC—Continued

A. SPECIES WITH AUXILIARY CLAWS

2. Tarsus as long as or longer than propodus, or more than two-thirds as long ... 3
   Tarsus conspicuously shorter, usually about two-thirds as long as, or less than, propodus ... 14
3. With prominent or well-defined processes over bases of chelifores ... 4
   Without tubercles or processes over base of chelifores, but bases often roundly swollen ... 5
4. Tubercles large, rounded at apices; spines on propodus not conspicuously large ... **striatum**
   Tubercles small, bluntly pointed; spines on propodus as long as diameter of joint ... **basispinosum** (p. 273)
5. With large spines on sole of propodus ... 6
   Without large spines, or spines not more than half as long as diameter of propodus ... 9
6. Tarsus and propodus subequal, or tarsus slightly longer, but not twice as a long as propodus ... 7
   Tarsus twice as long as propodus, large spines on sole usually two, well spaced near middle of joint ... **elongatum** (p. 251)
7. Large spines more than two, not restricted to middle of joint, or, if two, confined to heel ... 8
   With two large spines near middle of propodus ... **gunteri** (p. 257)
8. Two (sometimes three) large spines on heel of propodus ... **heterospinum** (p. 259)
   Several spines on sole of propodus, not restricted to heel ... **grossipes** (p. 247)
9. Tarsus conspicuously longer (one-and-a-half or twice as long) than propodus ... 10
   Tarsus usually equal to propodus, or not conspicuously longer ... 11
10. Auxiliary claws about half as long as terminal claw ... **pixellae**
    Auxiliary claws a third as long, or less, than terminal claw ... **longitarse** (p. 247)
11. Fourth joint of palpus as long as or not conspicuously shorter than fifth ... 12
    Fourth joint of palpus half as long as fifth ... **hodgsoni** (p. 250)
12. Auxiliary claws about half as long as terminal claw ... 13
    Auxiliary claws less than half as long as terminal claw ... **molum** (p. 271)
13. Chelae small, fingers rather short, wedge shaped, with fine teeth ... **micronyx**
    Chelae large, fingers long, slender, with numerous large teeth. **japonicum** (p. 249)
14. Origin of oviger well back on neck, immediately anterior to first lateral processes ... 15
    Origin of oviger out on neck just behind base of chelifores. **micropedes** (p. 254)
15. With large spines on sole of propodus ... 16
    Without large spines on sole of propodus ... 20
16. Without stiff bristlelike setae on scape and trunk ... 17
    With stiff bristle or thornlike setae on scape, trunk, and long segments of legs ... 18
17. Spines as long as thickness of propodus or shorter, but not conspicuously longer; fingers of chelae wedge shaped, with close-set teeth ... 19
    Spines of propodus longer than thickness of joint; fingers of chelae slender, with well-spaced teeth ... **dissimilis** (p. 262)
18. Lateral processes well separated by about half their diameter. **microsetosum** (p. 274)
    Lateral processes contiguous, or almost so ... **duospinum** (p. 274)
19. Tarsus about twice as long as thick ... **brevirostre** (p. 248)
    Tarsus usually more than twice as long as thick ... **grossipes** (p. 247)

KEY TO SPECIES OF NYMPHON FROM THE NORTH PACIFIC—Continued

A. SPECIES WITH AUXILIARY CLAWS—continued

20. Fingers of chelae as long as palm, with 20 or more teeth on the dactylus--20
Fingers of chelae shorter than palm, 10–12 teeth on the dactylus.
benthos (p. 256)
21. Trunk thickset, relatively heavy; chelae and tibiae not conspicuously setose.
braschnikowi (p. 250)
Trunk slender, graceful; chelae and tibiae with long, fine setae.
kodanii (p. 252)

B. SPECIES WITHOUT AUXILIARY CLAWS

22. Tarsus equal to, or longer than propodus----------23
Tarsus shorter than propodus----------**nipponense** (p. 267)
23. Fourth joint of palpus equal to, or almost as long as fifth joint----------24
Fourth joint of palpus conspicuously shorter than fifth----------25
24. Teeth of chelae large, widely spaced; eye tubercle an inconspicuous mound or absent altogether, without eyes----------**profundum** (p. 270)
Teeth of chelae small, close set; eye tubercle prominent, with well-developed eyes----------**uniunguiculatum** (p. 263)
25. Terminal claw as long as propodus----------**albatrossi** (p. 263)
Terminal claw about half as long, or conspicuously shorter than propodus.
ohshimai (p. 266)

A. SPECIES WITH AUXILIARY CLAWS

NYMPHON GROSSIPES (O. Fabricius?) Krøyer

Nymphon grossipes Fabricius, 1780, p. 41.
Nymphon grossipes var. *mixtum* Schimkewitsch, 1930, pp. 416–421, figs. 107–109.
Nymphon grossipes var. *glaciale* Schimkewitsch, 1930, pp. 421–425, figs. 110–112.
Nymphon grossipes Losina-Losinsky, 1933, pp. 70–71.
?Nymphon brevirostre subsp. *glaciale* Losina-Losinsky, 1933, pp. 69–70.
Nymphon grossipes mixtum Giltay, 1934, p. 50.
Nymphon turritum Exline, 1936, pp. 416–418, figs. g–k.
Nymphon mixtum Ohshima, 1936, p. 862.—Hilton, 1942a, p. 5.
Nymphon oculospinum Hilton, 1942a, p. 5.
Nymphon nigrognathum Hilton, 1942a, p. 6.
Nymphon turritum Hilton, 1942a, p. 6.
Nymphon grossipes Hilton, 1942a, p. 7.

The characters used by Hilton in erecting his new species (pointed eye tubercle and heavy chitinized chelae) are the same remarked upon by Giltay in his specimens from British Columbia, and in view of the wide variation and ubiquitous distribution of this species, I do not believe they can stand as independent species.

Losina-Losinsky's *Nymphon brevirostre* subsp. *glaciale* is evidently part of the *grossipes-mixtum-glaciale* complex and probably should be considered under this species.

NYMPHON LONGITARSE Krøyer

Nymphon longitarse Krøyer, 1844, p. 112.
Nymphon longitarse var. *brevicollis* Losina-Losinsky, 1929, pp. 540–541, fig. 2, a–g.
Nymphon longitarse Schimkewitsch, 1930, pp. 434–441, figs. 118–120.

Nymphon longitarse var. *brevicollis* Losina-Losinsky, 1933, p. 68.
Nymphon longitarse Hilton, 1942a, pp. 3–4.—Ohshima and Kishida, 1947, p. 1006, fig. 2855.

Collecting records.—Albatross stations 4982 (1 ovigerous male, 1 female); 5020 (1 specimen); 5021 (3 specimens); 5023 (15 specimens, including ovigerous males); 5024 (1 female); 5025 (1 female); 5037 (1 female); 5040 (1 ovigerous male).

A circumpolar, Boreal Arctic species, usually in shallow water. Some of these specimens, notably from stations 5023 and 5024, are somewhat more compact than the others, suggesting Losina-Losinsky's variety *brevicollis*. All the *Albatross* stations are north of 42° (around Hokkaido), while variety *brevicollis* is reported from the vicinity of Vladivostok near 43° N.

NYMPHON MACRUM Wilson

Nymphon macrum Ohshima, 1936, p. 862.

Although Ohshima states that he "observed one specimen in a collection from Sagami Bay," this species is not represented in these collections, and Ohshima's record may be a mistake, or it may be confused with *N. japonicum*. *Nymphon macrum* is not known to be circumpolar, but is found in the North Atlantic as far south as Cape Hatteras and in the Barents Sea.

NYMPHON BREVIROSTRE Hodge

Nymphon brevirostre Hodge, 1863, p. 464.
Nymphon gracile Sars, 1891, pp. 55–58, pl. 5, fig. a–h.
Nec *Nymphon brevirostre* Losina-Losinsky, 1929, pp. 542–546, fig. 3, a–g.
Non *Nymphon brevirostre* subsp. *glaciale* Losina-Losinsky, 1933, pp. 69–70.
Nymphon brevirostre Derjugin et al., 1935, pp. 11–57.—Stephensen, 1936, p. 10.
Nymphon microcollis Hilton, 1942a, p. 5.
Nymphon gracile Hilton, 1942a, p. 7.

Losina-Losinsky's (1929) proposal to use this name as a group designation for several closely related forms (which are arranged in a bewildering array of varieties, subspecies, and forms) is unfortunate. According to the synonymy by Stephensen this name belongs to the species described and figured by Sars as *Nymphon gracile*, and the taxonomic group proposed by Losina-Losinsky does not include this species at all.

The specimen for which Hilton has proposed the name *microcollis* agrees closely with Sars's figure, and is readily separable from *Nymphon brevitarse*, which Losina-Losinsky reduced to subspecific rank under *N. brevirostre*, and which I suggested (1943a, p. 89) might be the species identified by Hilton as *N. gracile* Leach. These various names have become so confused that it is almost hopeless to be certain of an identification. Thus one of the purposes of the binomial

system has been defeated, and it looks very much as if the taxonomists themselves are the culprits. This confusion is hardly clarified by the elaborate treatment of Derjugin et al., which follows Losina-Losinsky's revisions but also includes *N. brevirostre* auct.

NYMPHON JAPONICUM Ortmann

FIGURE 20

Nymphon japonicum ORTMANN, 1891, pp. 158–159, pl. 24, fig. 1.—LOMAN, 1911, p. 8.—OHSHIMA, 1936, p. 8.

Non *Nymphon japonicum* OHSHIMA and KISHIDA, 1947, p. 1107, fig. 2856.

Collecting records.—Albatross stations 3698; 3701 (2 females); 3708 (2 specimens); 3730 (1 female); 3734 (2 females); 3750 (1 ovigerous male); 3752 (1 female); 3755 (1 female); 3757 (1 specimen); 4809 (1 female); 4826 (25 specimens); 4829 (1 male); 4833 (1 male); 4934 (20 specimens, including ovigerous males); 4936 (1 female).

Although Ortmann's description and figure are not all that could be desired, there seems to be no other species in the collection that agrees as well with his description as do these specimens and they are therefore referred to *Nymphon japonicum*. This is a large handsome species, apparently restricted to Japanese waters and therefore appropriately named, as is not often the case with geographically

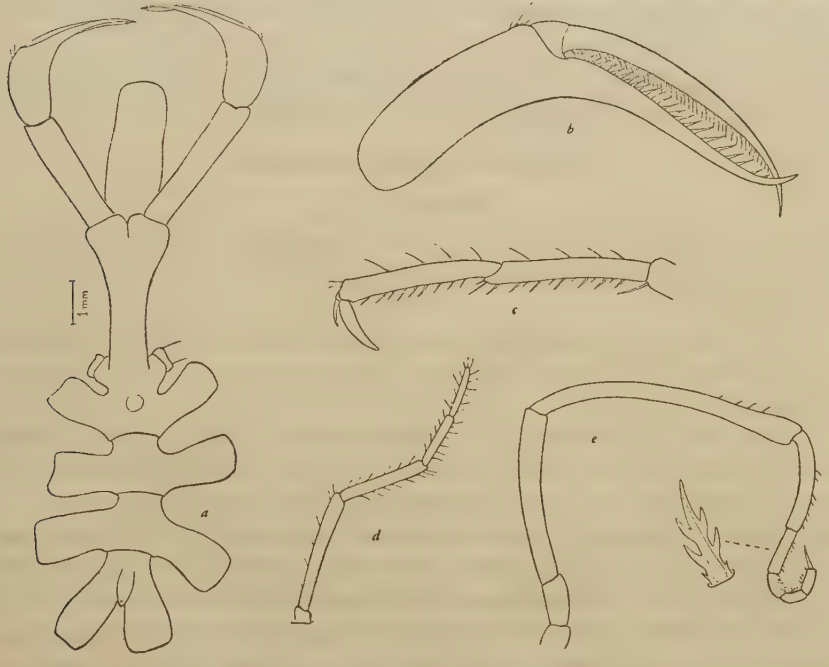

FIGURE 20.—*Nymphon japonicum* Ortmann: *a*, Trunk; *b*, chela; *c*, tarsus; *d*, palpus; *e*, oviger.

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inspired specific names. The terminal claw is of variable length, in some specimens (in the lot from station 4826) being half as long as the propodus. The figure in Ohshima and Kishida's catalog suggests the species described below as *Nymphon micropedes*, although it is too small for detailed comparison. Their figure indicates a species with a short tarsus, whereas the one clear detail of Ortmann's figure is the subequal condition of the tarsus and propodus, and it also indicates a much longer second coxa than represented in Ortmann's figure and my material.

This species is generally a southern form, but it evidently occurs occasionally as far north as about 40° (station 4809) and is found on both sides of Honshu.

NYMPHON BRASCHNIKOWI Schimkewitsch

FIGURE 21, *a–c*

Nymphon braschnikowi SCHIMKEWITSCH, 1906, pp. 248–251.
Nymphon braschnikovi SCHIMKEWITSCH, 1930, pp. 507–512, figs. 154–160, pl. 9, figs. 1–2.—OHSHIMA, 1936, p. 863.

Collecting records.—*Albatross* stations 5024 (1 male); 5025 (6 specimens); 5026 (1 female); 5037 (50 specimens); 5038 (100 specimens).

This is apparently one of the characteristic species of the Sea of Okhotsk, but the two large collections (stations 5037 and 5038) were made off the southern shore of Hokkaido. Its bathymetric range is from 52 to 175, or perhaps 349, fathoms. Several specimens in the larger lots are larvigerous. Most of them are a reddish brown color in alcohol. This species has not been found south of latitude 42° N.

NYMPHON HODGSONI Schimkewitsch

FIGURE 21, *d–g*

Nymphon hodgsoni SCHIMKEWITSCH, 1913, pp. 244–248, pl. 3a, figs. 15–25; 1930, pp. 512–517, figs. 161–166, pl. 10.—OHSHIMA, 1936, p. 863.—LOSINA-LOSINSKY, 1933, p. 71.

Collecting records.—*Albatross* stations 5018 (4 males, 3 females); 5020 (2 females, 1 juvenile); 5021 (10 specimens); 5023 (2 females, 1 juvenile).

This species is similar to *N. braschnikowi* in general appearance, but it never has the short tarsal segment of that species, and it is usually much larger. It occupies about the same bathymetric and geographic range as *N. braschnikowi* and it is possible that the two are actually varieties of each other, although I could find no transitional forms. In *N. hodgsoni* the shape of the chela is not as variable as in *N. braschnikowi*, where it varies from a graceful curve to the blunt *grossipes* type. *Nymphon hodgsoni* has not been collected south of latitude 48° 30′ N.

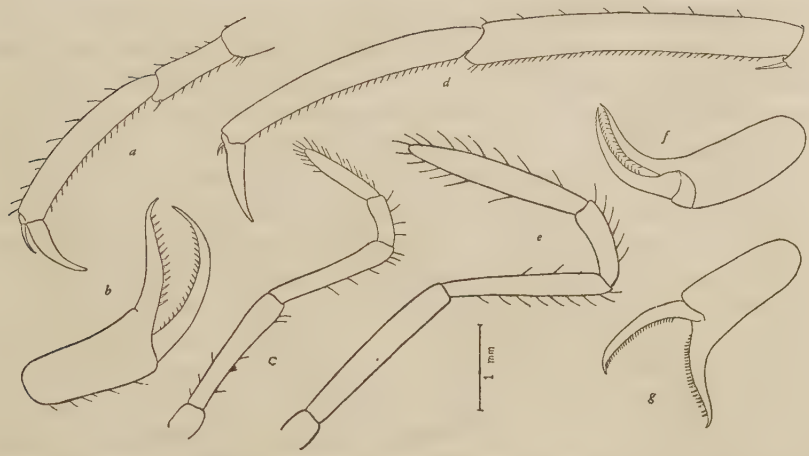

FIGURE 21.—*a-c, Nymphon braschnikowi* Schimkewitsch: *a*, Tarsus and propodus; *b*, chela and palpus; *c*, palpus. *d-g, N. hodgsoni*, Schimkewitsch: *d*, Tarsus and propodus; *e*, palpus; *f*, *g*, chelae.

NYMPHON ELONGATUM Hilton

FIGURE 22; FIGURE 34, *f*

Nymphon elongatum HILTON, 1942a, p. 5.

Collecting records.—Albatross stations 4822 (1 ovigerous male); 5023 (1 ovigerous male, 1 female).

The combination of a long propodus and a small chela is rare in the genus, and constitutes one of the principal characters for identification of this species. In the type specimen I found two large spines on the sole of the propodus, as in one of the other specimens, but in some of the material these are inconspicuous or lacking and on other legs of the same specimens there may be several. The proportions of the palpal segments, conformation of the chela, and shape of the denticulate spines are relatively constant, however. The formulae for the spines on the terminal segments of the ovigers is usually 15:15:15:12::20.

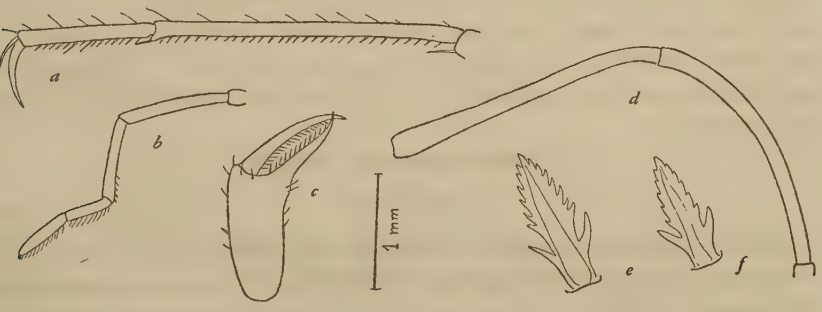

FIGURE 22.—*Nymphon elongatum* Hilton: *a*, Tarsus and propodus; *b*, palpus; *c*, chela; *d*, fourth and fifth joints of oviger; *e*, spine of oviger; *f*, spine from oviger of holotype.

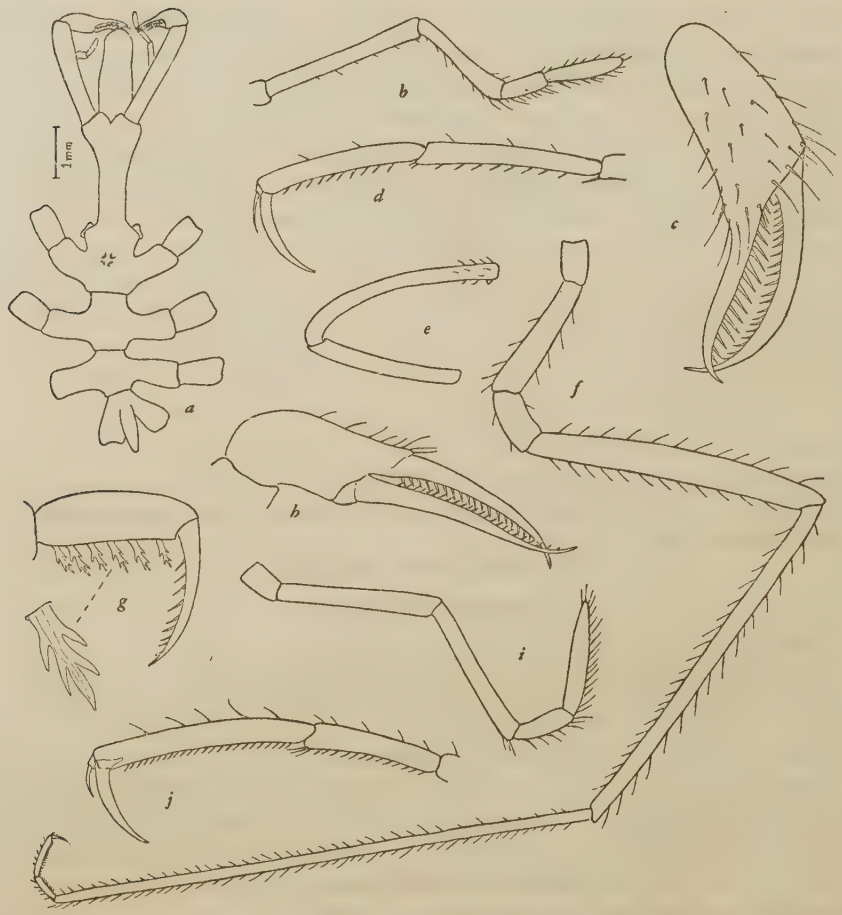

FIGURE 23.—*Nymphon kodanii*, new species: *a*, Dorsal view of holotype; *b*, palpus of holotype; *c*, chela of holotype; *d*, tarsus and propodus, holotype; *e*, fourth and fifth joints of oviger, holotype; *f*, third leg, holotype; *g*, terminal joint of oviger, holotype; *h*, chela, paratype; *i*, palpus, paratype; *j*, tarsus and propodus, paratype.

This is apparently a species of the central North Pacific. The type specimens are from *Albatross* station 4792, latitude 54°36′15″ N., longitude 166°57′15″ E., 72 fathoms, June 14, 1906. *Albatross* station 4822, at latitude 37°08′10″ N. is the southernmost record for this species.

NYMPHON KODANII, new species

FIGURE 23

Types.—Holotype (male): U.S.N.M. No. 80594, *Albatross* station 4977, latitude 33°23′ N., longitude 135°37′40″ E., 544 fathoms, 38.9° F., August 31, 1906.

Paratype (male): *Albatross* station 4971, latitude 33°23′30″ N., longitude 135°34′ E., 649 fathoms, 38.1° F., August 30, 1906.

Other collecting records.—Albatross stations 3697 (10+ specimens); 3698 (6 specimens); 4965 (1 female).

Description.—Trunk moderately elongate, lateral processes separated by slightly more than their width, body without processes, tubercles, or conspicuous setae. In some specimens the trunk is more closely set. Eye tubercle slightly higher than width at base, bluntly rounded at top, with large well-developed (heavily pigmented) eyes near the apex. Neck about three times as long as wide.

Proboscis as long as neck, cylindrical, and bluntly rounded at tip.

Abdomen papilliform, about as long as last lateral process, directed at an angle of about 50°.

Chelifore about two-thirds the diameter of the neck, as long as proboscis. Chelae fairly heavy, the palm and fingers almost equal in length, fingers slender, curved, crossing at tips and armed with about 17 to 20 to 25 spines on the immovable finger and 20 to 30 on the dactylus. Palm well covered with large setae in some specimens, almost glabrous in others.

Palpus somewhat longer than proboscis, slender, hairy. Fourth joint conspicuously shorter than fifth, the two together slightly longer than the third.

Oviger: Fourth joint not strongly curved, about as long as the fifth, which is straight and weakly clavate. There are a few stiff spines near the base of the fifth joint on the outer side. Compound spines large, coarse, with two pairs of large denticulations. Terminal claw as long as segment, with 8 to 9 well-spaced spines. Formulae of spines: 11:7:7:6::8–9.

Leg: First and third coxae subequal, as long as broad; second coxa somewhat longer than first and third together. Femur straight, about one and a half times as long as the coxae. First tibia not conspicuously longer than femur, second tibia longer than first. The tibiae are slender and sticklike and moderately setose. Tarsus and propodus subequal, with a row of small well-separated spines on ventral surface. Terminal claw large, slender, and well curved, about two-thirds as long as propodus. Auxiliary claws slender, about half as long as terminal claw.

Measurements (paratype, male) as follows:

	Mm.
Proboscis	1.5
Trunk	5.5
Second lateral process, width	3.0
Abdomen	1.0
Scape	2.0
Chela	3.25
Palpus	4.0

Third leg:	*Mm.*
First coxa	0.75
Second coxa	2.5
Third coxa	1.0
Femur	5.75
First tibia	7.5
Second tibia	10.8
Tarsus	1.1
Propodus	2.0
Terminal claw	0.75
Auxiliary claw	0.25

Remarks.—This species resembles *Nymphon leptocheles* Sars, from which it differs principally in the structure of the palpus, the fourth joint being much shorter, the longer auxiliary claws, and the coarse toothed spines of the oviger. The specimens exhibit some variation in the length of the tarsal joint, conformation of the palpus, and setose investiture of the trunk and legs, but the ovigers and chelae are comparatively constant (in fig. 23, *c* and *h*, the differences are exaggerated by the angles from which they were drawn), and I suspect that intermediate forms will eventually be collected. This is evidently a warm-water species as all the records are south of 33°.

This species is named for Dr. Masui Kodani, of the University of Rochester, who has been of great help in translating Japanese references.

NYMPHON MICROPEDES, new species

FIGURE 24

Holotype (*male*).—U.S.N.M. No. 80591, *Albatross* station 5080, latitude 34°10′30″ N., 138°40′ E., 505 fathoms, 38.7° F., October 19, 1906.

Description.—Trunk elongate, slender, lateral processes separated by almost twice their diameter and not much longer than broad. Neck about three times as long as wide, the bases of the ovigers near the anterior end just beyond the origin of the scape. Eye tubercle a low rounded mound, eyes absent.

Proboscis about as long as neck, cylindrical, and squarish at tip.

Abdomen slender, papilliform, about three times as long as wide, directed at an angle of about 45°.

Chelifore: Scape as long as proboscis, moderately robust; chela longer than scape, fingers slightly longer than palm, almost straight but curved and crossing at the tip. Both fingers are armed with numerous close-set spinules.

Palpus longer than proboscis, slender, second and third joints subequal, fourth and fifth subequal but together shorter than the third. Last three joints invested with fine setae.

Oviger rather long and slender, fourth joint slightly curved, with a slight projection at the proximal fourth on the outer side, fifth joint not quite twice as long as fourth, nearly straight, slightly expanded distally. Compound spines of terminal segments large, with usually two pairs of coarse denticulations. Terminal claw as long as joint, with half a dozen well-spaced teeth. Formula: 9 : 6 : 6 : 6 :: 6.

Leg: First and third coxae slightly longer than wide, subequal. Second coxa about twice as long as first and third together. Femur about one-and-a-half times as long as the coxae, weakly arched and with a low projection on the midventral surface which is the site of a pore. First tibia slightly longer than femur, about half as long as

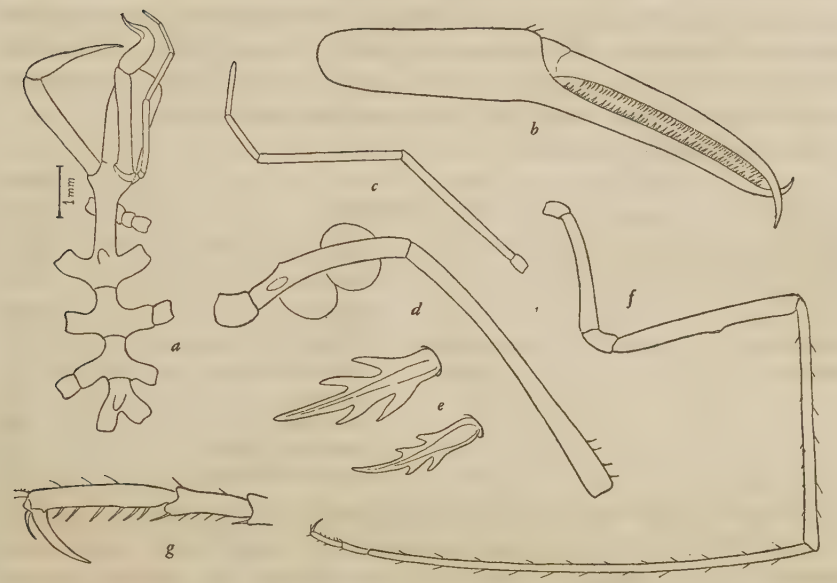

FIGURE 24.—*Nymphon micropedes*, new species: *a*, Dorsolateral view of holotype; *b*, chela; *c*, palpus; *d*, fourth and fifth joints of oviger; *e*, compound spines; *f*, third leg; *g*, tarsus and propodus.

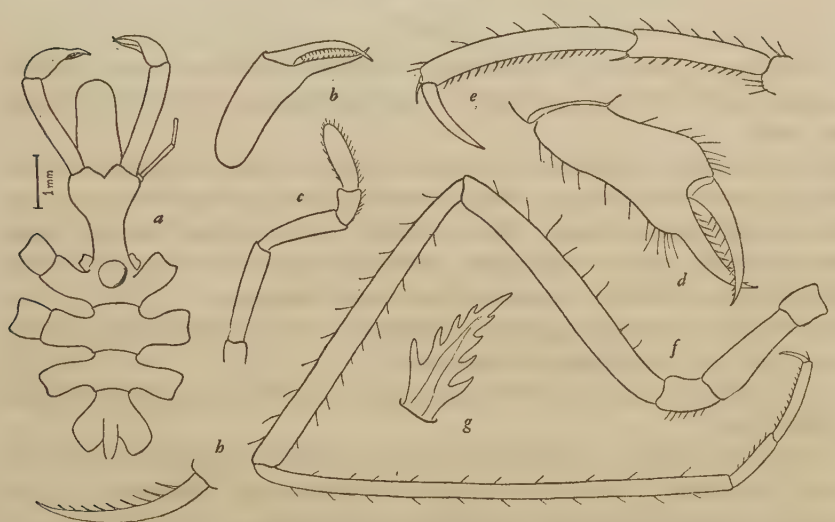

FIGURE 25.—*Nymphon benthos*, new species; *a*, Dorsal view of trunk; *b*, chela; *c*, palpus; *d*, chela, anterior oblique view; *e*, tarsus and propodus; *f*, third leg; *g*, compound spine of oviger; *h*, terminal claw of oviger.

second tibia. Tibiae armed with slender, hairlike setae. Tarsus about two-thirds as long as propodus, with a few moderately large spines on ventral surface. Propodus with half a dozen large spines well spaced along sole. Terminal claw heavy, curved, half as long as propodus; auxiliary claws half as long as terminal claw.

Measurements.—As follows:

	Mm.
Proboscis	2.0
Trunk	4.5
Second lateral process, width	1.75
Abdomen	.25
Scape	2.0
Chela	2.25
Palpus	3.75

	Mm.
Third leg:	
First coxa	0.5
Second coxa	2.4
Third coxa	.6
Femur	3.6
First tibia	4.5
Second tibia	8.75
Tarsus	.4
Propodus	.75
Terminal claw	.5
Auxiliary claw	.1

Remarks.—This species is easily distinguished by its combination of very small tarsus and propodus and the large chelae with their slender straight fingers. The locality at which this species was collected is southwest of Sagami Bay. As already remarked above, this seems to be the species identified by Ohshima and Kishida as *N. japonicum.*

NYMPHON BENTHOS, new species

FIGURE 25

Holotype (female).—U.S.N.M. No. 80586, *Albatross* station 5085, latitude 35°06′45″ N., 139°19′45″ E., 622 fathoms, 37.8° F., October 23, 1906.

Description.—Trunk oval in outline, lateral processes separated by about their own diameter. Neck about as long as first two trunk segments, moderately heavy. Eye tubercle erect, between two and three time as high as median diameter, smoothly rounded at top, with well-developed but faintly pigmented eyes near the apex.

Proboscis about as long as neck, cylindrical and rounded at tip, diameter slightly larger than that of neck.

Abdomen as long as last lateral process, papilliform, with a rounded conical tip.

Chelifore: Scape as long as proboscis, diameter about half that of neck, chela small, about two-thirds as long as scape. Fingers about as long as palm, intermediate between the wedge-shaped and long slender type, armed with less than 15 teeth on each finger.

Palpus short, thickset, third joint shorter than second, fourth joint about half as long as fifth, the two together somewhat longer than the third.

Oviger moderately long, the fourth segment shorter than the fifth, both segments relatively straight. Compound spines of terminal joints relatively large, with three or four pairs of coarse denticulations. Formula: 9:6:6:6::9–10.

Leg moderately long, femur and tibial joints armed with short stiff setae. First and third coxae subequal, second coxae about as long as first and third together. Femur about one-and-a-half times as long as coxae, slightly arched. First tibia slightly longer than femur, second tibia half again as long as first. Tarsal joints small, tarsus not quite so long as propodus, ventral surfaces of both joints with a row of well-separated short spines. Terminal claw heavy, less than half as long as propodus. Auxiliary claws very small, less than one-fifth as long as terminal claw.

Measurements.—As follows:

	Mm.
Proboscis	1.8
Trunk	5.0
Second lateral process, width	2.75
Abdomen	.8
Scape	2.0
Chela	1.7
Palpus	3.6

Third leg:	*Mm.*
First coxa	0.8
Second coxa	2.0
Third cova	1.0
Femur	6.0
First tibia	6.5
Second tibia	10.0
Tarsus	1.25
Propodus	1.9
Terminal claw	.75
Auxiliary claw	.2

Remarks.—This species most nearly resembles *N. micronyx* Sars which Schimkewitsch (1930, pp. 476–478) identified from Kamchatka, but I cannot identify this specimen with that species because of the coarse toothed spines of the oviger and the very short auxiliary claws, as well as the considerably greater depth from which it was collected, inasmuch as *N. micronyx* is recorded in depths from 4 to 38 meters. It may be considered a Pacific Ocean form or variety of *Nymphon micronyx* unless Schimkewitsch's specimen is a good *micronyx;* in which case it should be considered a separate species and the circumpolar distribution of *N. micronyx* established on the basis of Schimkewitsch's determination. Derjugin et al. (1935, p. 30) suggest that the Kamchatka specimen is actually *N. brevirostre* auct.

NYMPHON GUNTERI, new species

FIGURE 26

Holotype (*female*).—U.S.N.M. No. 80588, *Albatross* station 5050, latitude 38°11′30″ N., longitude 142°08′ E., 266 fathoms, 37.9° F., October 10, 1906.

Description.—Trunk moderately elongate, lateral processes sepa-

rated by about their own diameter. Neck short, relatively thick. Eye tubercle low, bluntly rounded, with well-developed eyes.

Proboscis: About one and a half times as long as neck, slender, cylindrical, and rounded at tip.

Abdomen as long as last lateral processes, papilliform, rounded at tip, erect at an angle of about 45°.

Chelifore: Scape slender, not quite as long as proboscis, slightly arched. Chela about as long as scape, fingers and palm subequal. Fingers moderately heavy, well arched, armed with 10 relatively heavy spinules on the immovable finger and about 15 on the dactylus.

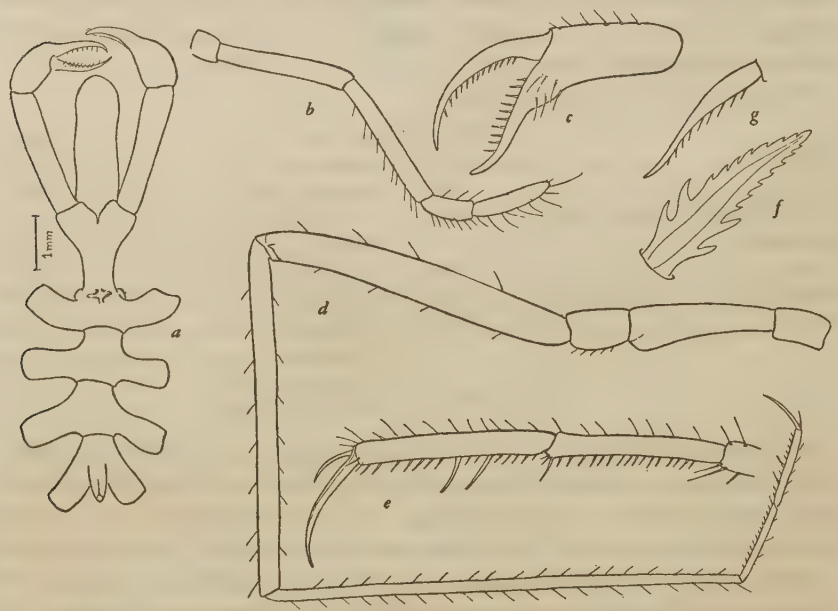

FIGURE 26.—*Nymphon gunteri*, new species: *a*, Dorsal view of holotype; *b*, palpus; *c*, chela; *d*, third leg; *e*, tarsus and propodus; *f*, compound spine of oviger; *g*, terminal claw of oviger.

Palpus slender, the last two joints overreaching the proboscis. Second and third joints subequal, fourth joint little more than half as long as fifth, the two together as long as the third. Terminal joints armed with fine setae.

Oviger: Fourth and fifth joints subequal, relatively straight, the fifth slightly expanded distally. Compound spines of terminal joints moderately broad, with two pairs of basal denticulations, and several pairs of finer, but relatively coarse, deticulations toward the end.

Third leg: First and third coxae about as long as broad, subequal, second coxae not quite so long as first and third together. Femur not markedly shorter than first tibia. Second tibia about one-and-

one-half times as long as first. Tibial joints armed with fine well-spaced setae. Tarsus and propodus subequal, the tarsus with a row of evenly spaced rather long ventral spines, the propodus with a similar row, interrupted near the middle by a pair of large spines, which are slightly longer than the diameter of the propodus. Terminal claw slightly more than half as long as propodus, slightly curved and with a distal knife edge. Auxiliary claw about a third as long as terminal claw.

Measurements.—As follows:

	Mm.
Proboscis	2.75
Trunk	5.1
Second lateral process, width	3.0
Abdomen	.75
Scape	2.5
Chela	ca. 2.5
Palpus	3.75

Third leg:	Mm.
First coxa	1.0
Second coxa	2.5
Third coxa	1.25
Femur	6.0
First tibia	7.0
Second tibia	9.5
Tarsus	1.5
Propodus	1.7
Terminal claw	1.0
Auxiliary claw	.4

Remarks.—The two large spines of the propodus suggest *Nymphon elongatum* Hilton, but the tarsus is subequal to the propodus in this species instead of considerably longer as in Hilton's species, the compound spines of the oviger are coarsely instead of finely toothed, and the conformation of the chela is noticeably different. The locality from which this species was taken is north of Honshu.

I have named this species for my friend and colleague Dr. Gordon Gunter, who listened to me patiently while this report was in preparation.

NYMPHON HETEROSPINUM, new species

FIGURE 27

Holotype (*ovigerous male*).—U.S.N.M. No. 80589, *Albatross* station 5050, latitude 38°11′30″ N., 142°08′ E., 266 fathoms, 37.9° F., October 10, 1906.

Description.—Trunk elongate, lateral processes separated by slightly more than their own diameter. Neck short, thick. Eye tubercle about twice as high as broad, with a sharp forward-directed point, eyes rather small but well pigmented, about halfway between base and tip of tubercle.

Proboscis about twice as long as neck, heavy, cylindrical, but slightly expanded at tip, and broadly rounded.

Abdomen erect, almost vertical, not quite as long as last lateral process.

Chelifore: Scape shorter than proboscis, relatively stout. Chela heavy, as long as scape, palm somewhat longer than fingers, fingers wedge shaped, armed with fine short teeth.

Palpus relatively thick, somewhat longer than proboscis, second and third joints subequal, fourth joint slightly shorter than fifth, the two together a little longer than the third joint, terminal joints armed with fine setae.

Oviger: Fourth joint about half as long as fifth, slightly curved in its distal third, fifth joint straight, moderately clavate. Compound spines small, close set, with fine denticulations and a pair of coarser ones near the base. Terminal claw with about 20 very fine spinules, formula: 18 : 17 : 17 : 15 :: 20.

Third leg: Third coxa slightly longer than first, second almost twice as long as the two together. Femur about twice as long as second coxa, slightly arched. First tibia not conspicuously longer than femur, second tibia half again as long as first. Femur and tibiae sparsely armed with very fine setae. Tarsus and propodus subequal, tarsus with a row of well-spaced short spines along the ventral surface. Propodus moderately arched, with two large spines near the heel and a row of small spines along the rest of the sole. Terminal claw slightly more than half as long as propodus, curved. Auxiliary claw about half as long as terminal claw.

Measurements.—As follows:

	Mm.
Proboscis	2.0
Trunk	6.0
Second lateral process, width	3.1
Abdomen	.75
Scape	2.0
Chela	2.25
Palpus	3.0

Third leg:	*Mm.*
First coxa	1.0
Second coxa	3.5
Third coxa	1.25
Femur	7.0
First tibia	7.5
Second tibia	10.5
Tarsus	1.5
Propodus	1.5
Terminal claw	1.0
Auxiliary claw	.4

Remarks.—Although taken at the same station as the preceding species, *N. heterospinum* is markedly different in the structure of the chela, position of the large spines on the propodus, and the finely serrated compound spines of the oviger. Some of these characters suggest *Nymphon grossipes*, but I have not noticed any specimens of this highly variable species in which the large spines of the propodus are restricted to the heel as in this specimen.

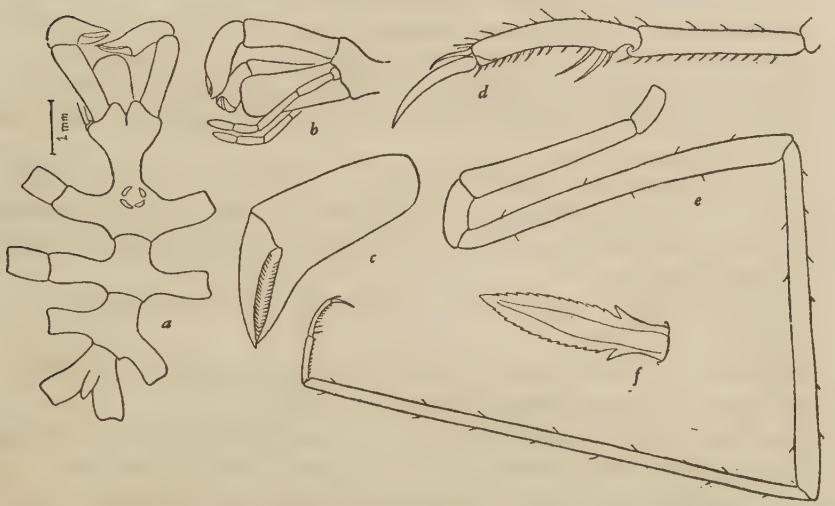

FIGURE 27.—*Nymphon heterospinum*, new species: *a*, Dorsal view of holotype; *b*, lateral view of anterior region; *c*, chela; *d*, tarsus and propodus; *e*, third leg; *f*, terminal spine of oviger.

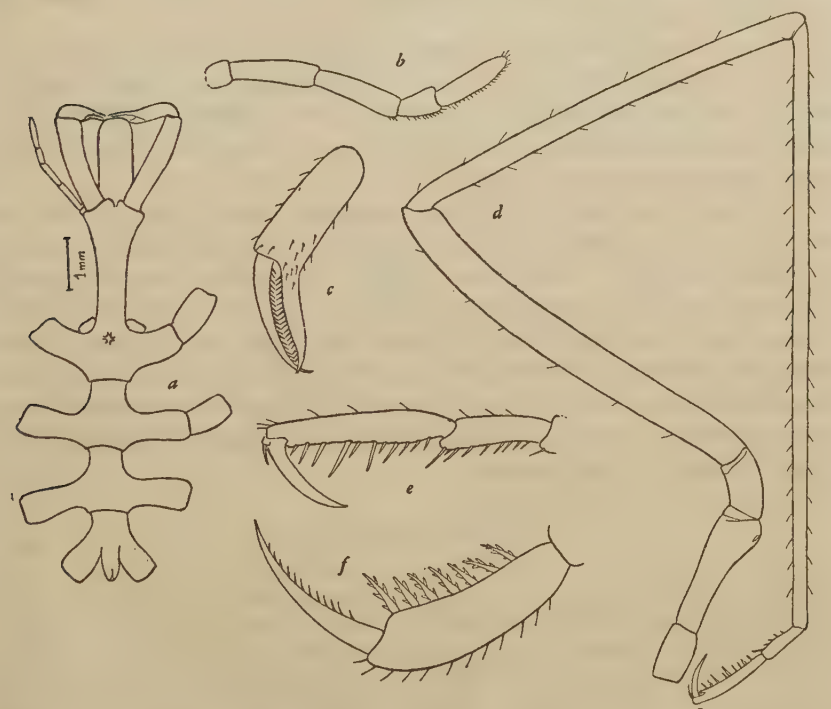

FIGURE 28.—*Nymphon dissimilis*, new species: *a*, Dorsal view of holotype; *b*, palpus; *c*, chela; *d*, third leg; *e*, tarsus and propodus; *f*, terminal joint of oviger.

NYMPHON DISSIMILIS, new species

FIGURE 28

Holotype (*female*).—U.S.N.M. No. 80587, *Albatross* station 4780, latitude 52°01′ N., longitude 174°39′ E., 1,046 fathoms, 35.9° F., June 7, 1906.

Description.—Trunk smooth, elongate, narrowly oval in outline, lateral processes separated by one and one-half times their diameter. Neck long, slender. Eye tubercle prominent, narrowly pointed, and with four large eyes.

Proboscis slightly heavier and shorter than neck, cylindrical, and boldly rounded at tip.

Abdomen not quite so long as last lateral process, papilliform, rounded at tip, directed at an angle of about 40°.

Chelifore: Scape rather heavy, shorter than proboscis. Chela about as long as scape, palm moderately thick, fingers about as long as palm, slender, moderately curved, with more than 20 well-spaced short spinules on each finger.

Palpus somewhat longer than proboscis, second and third joints subequal, fourth segment half as long as fifth, the fifth alone almost as long as the third.

Oviger: Fourth joint rather heavy, straight, with a large pore near the proximal end, fifth joint about a third again as long, straight, slightly swollen distally. Compound spines coarsely toothed, terminal claw slender, curved, almost as long as terminal joint, with a dozen or more spinules. Spine formula: 10 : 8 : 8 : 7 :: 12.

Third leg: First and third coxae subequal, second coxae as long as first and third together. Femur not quite twice as long as coxae, relatively straight. First tibia slightly longer than femur, second tibia half again as long as first, with an investment of fine setae. Tarsus little more than half as long as propodus, with coarse spines along sole. Propodus with much heavier spines, some of them longer than the diameter of the joint, scattered between shorter spines. Terminal claw heavy, half as long as propodus. Auxiliaries about one-fourth as long as terminal claw.

Measurements.—As follows:

	Mm.
Proboscis	+1.5
Trunk	6.5
Second lateral process, width	3.25
Abdomen	.6
Scape	2.0
Chela	2.0
Palpus	2.75

Third leg:	*Mm.*
First coxa	1.0
Second coxa	2.5
Third coxa	1.1
Femur	8.0
First tibia	8.25
Second tibia	11.25
Tarsus	.8
Propodus	1.6
Terminal claw	.75
Auxiliary claw	.2

Remarks.—This species has no salient characters; it is just something that fails to fit in. Except for the rather slender chelae and the coarse compound spines of the oviger it might be mistaken for *grossipes*. The presence of such large eyes suggests that perhaps the specimen was incorrectly labeled, for abyssal species are usually blind. The locality is southeast of Agattu, near the end of the Aleutian Chain.

B. SPECIES WITHOUT AUXILIARY CLAWS

NYMPHON UNIUNGUICULATUM Losina-Losinksy

FIGURE 29

Nymphon uniunguiculatum LOSINA-LOSINSKY, 1933, pp. 62–64, 78–79.

Collecting records.—Albatross stations 4854 (1 female); 4982 (1 female, juvenile).

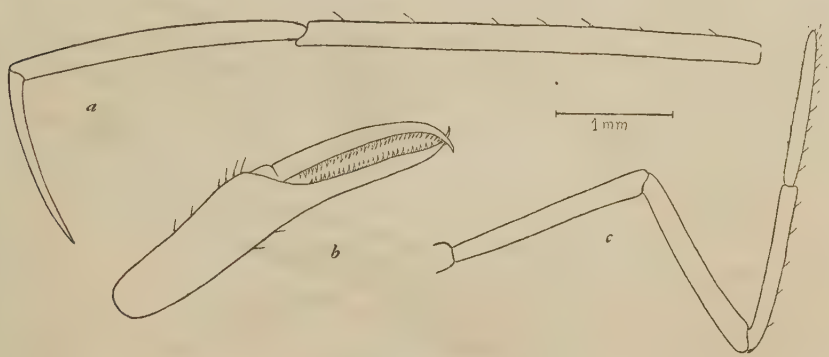

FIGURE 29.—*Nymphon uniunguiculatum* Losina-Losinsky: *a*, Tarsus and propodus; *b*, chela; *c*, palpus.

Previously reported from the vicinity of Peter the Great Bay on the Siberian edge of the Japanese Sea. These records extend the distribution southward to the coast of Korea, and northward to the western shore of Hokkaido. It is apparently restricted to moderately deep water, for Losina-Losinsky's records are from 510–545 and 167–340 meters.

NYMPHON ALBATROSSI, new species

FIGURE 30

Types.—Holotype (ovigerous male): U. S. N. M. No. 80584, *Albatross* station 4826, latitude 37°25′ N., longitude 137°32′ E., 114 fathoms, 42.5° F., July 21, 1906.

Paratypes (3 females): *Albatross* station 4915, latitude 31°31′ N., longitude 129°25′30″ E., 427 fathoms, August 12, 1906.

Additional collecting records.—*Albatross* stations 4842 (2 females); 4909 (2 females); 4913 (1 females); 4919 (2 specimens, probably females).

Description.—Trunk elongate, lateral processes well separated by from about half to equal their diameter. Integument smooth. Neck of variable length, from three or four times as long as broad to about half that length. Eye tubercle a low, rounded to square-topped knob.

Proboscis as long as or longer than neck, or about three times as long as broad, roughly cylindrical but slightly swollen near middle and tip, largest distally.

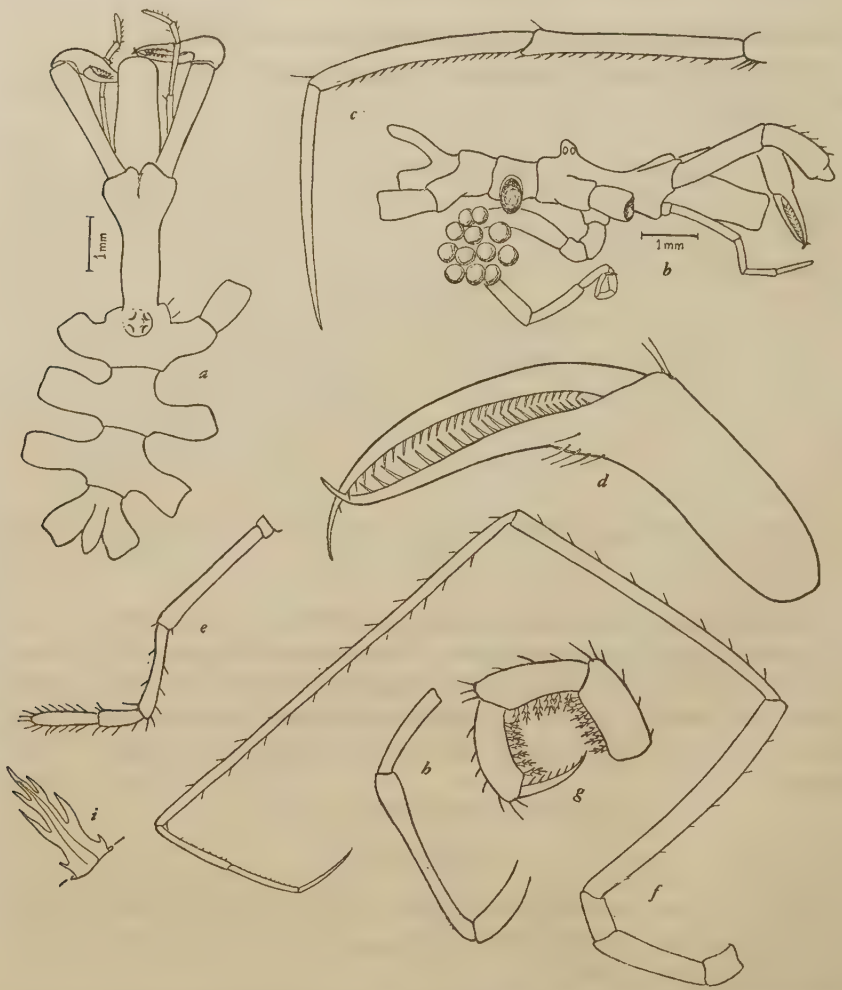

FIGURE 30.—*Nymphon albatrossi*, new species: *a*, Dorsal view, paratype; *b*, lateral view, holotype; *c*, tarsus and propodus; *d*, chela, paratype; *e*, palpus; *f*, third leg, holotype; *g*, terminal joints of oviger; *h*, fourth and fifth joints of oviger.

Abdomen longer than lateral process, slightly curved, tapering in distal half, directed at an angle of 45°.

Chelifore: Scape heavy, about as long as proboscis; chela longer than scape, slender, curved. About 15 to 25 large well-separated teeth on immovable claw and from 16 to 30 teeth on the dactylus.

Palpus slender, straight, with fine setae on the terminal joints. In some specimens the fourth joint is noticeably shorter than the fifth; in others it is almost as long.

Third leg: First and third coxae subequal, from slightly longer than their diameter to almost twice that length. Second coxa about as long as first and third together. Femur slightly arched, slightly shorter than first tibia. Tibiae straight, sticklike, subequal, with a scattering of fine setae. Tarsus and propodus subequal, with a row of well-separated fine spines along the ventral surface. Terminal claw almost straight, as long as propodus. No auxiliary claws.

Oviger: Fourth joint slightly curved; fifth joint almost straight, expanded distally to about twice the median diameter. Compound spines large, with three or four pairs of coarse denticulations. Terminal claw almost as long as terminal joint, with 6 to 12 widely separated spines. There are usually six or seven compound spines on each joint. Formula: 7:7:6:7::7.

Measurements (holotype) as follows:

	Mm.
Proboscis	2.0
Trunk	7.5
Second lateral process, width	3.5
Abdomen	1.0
Scape	2.1
Chela	2.5
Palpus	4.5

Third leg:	*Mm.*
First coxa	0.75
Second coxa	2.0
Third coxa	1.0
Femur	5.1
First tibia	6.0
Second tibia	9.0
Tarsus	1.8
Propodus	1.9
Terminal claw	2.1

Remarks.—This species is close to *Nymphon longicoxa* Hoek, from the South Pacific near Auckland, but it differs in the following respects: The terminal claw is much longer, and the male oviger is straighter and lacks the peculiar processes on the dorsum described by Hoek. In many specimens the fourth joint of the palpus is shorter, but the variable length of this joint suggests a close relationship with Hoek's species. There is, however, no variation in the length of the terminal claw, and the propodus is not conspicuously longer than the tarsus as in *N. longicoxa*, nor does *N. albatrossi* have the very long second coxae of that species. It is readily distinguished from *N. uniunguiculatum* by the shorter fourth joint of the palpus, the larger teeth in the chelae, the coarser denticulations of the spines of the oviger, and the much longer terminal claw of the legs. This

appears to be a southern form, occurring approximately between latitude 30° and 36° N. and longitude 120° and 133° E., southeast and southwest of Honshu.

NYMPHON OHSHIMAI, new species

FIGURE 31

Holotype (*ovigerous male*).—U.S.N.M. No. 80590, *Albatross* station 4975, latitude 33°21′30″ N., longitude 135°38′50″ E., 545–712 fathoms, 37.5° F., August 31, 1906.

Description.—Trunk relatively short, lateral processes separated by less than their own diameter, forming an oval outline. Neck heavy, about twice as long as broad. Eye tubercle small, about one-and-a-half times as high as broad, rounded at tip and with small eyes, located on the anterior margin of the cephalic segment.

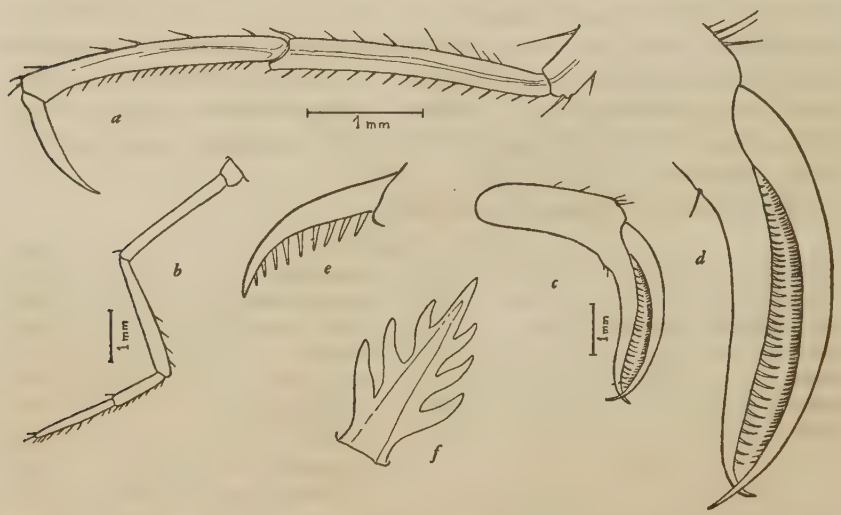

FIGURE 31.—*Nymphon ohshimai*, new species: *a*, Tarsus and propodus; *b*, palpus; *c*, chela; *d*, enlarged detail of chela; *e*, terminal claw of oviger; *f*, compound spine of oviger.

Proboscis thick, not much longer than neck, cylindrical and with a square tip.

Abdomen missing.

Chelifore: Scape about three-fourths the diameter of the neck, longer than the proboscis, slightly arched. Chela long, slender, with curved fingers as long as the palm. There are about 35 large well-separated spinules on the immovable finger, and about 80 short close-set spinules on the dactylus. There is a deep groove between the bases of the chelifores.

Palpus long, slender, second and third joints subequal, fourth somewhat shorter than fifth but not conspicuously so, the fourth and fifth

joints together slightly longer than the third. Terminal joints adorned with fine setae.

Oviger rather short and heavy. Fourth segment shorter than fifth, slightly curved; fifth segment straight, slightly dilate at distal end, but without conspicuous processes or spines. Compound spines of terminal segments large, with two or three pairs of coarse denticulations. Terminal claw large, with 8 or 9 picketlike spines. Formula: 13:11:9:9::9.

Third leg: First and third coxae quadrate, second coxa about two-and-a-half times as long as first and third together. Femur not quite as long as first tibia and slightly more than half as long as second. There are fine setae on the long joints. Tarsus and propodus subequal, with fine well-separated spines along the ventral surface. Terminal claw large, heavy, half to less than half as long as propodus. Auxiliary claws lacking.

Measurements.—As follows:

	Mm.
Proboscis	3.0
Trunk	9.0
Second lateral process, width	4.0
Abdomen	
Scape	4.5
Chela (chord)	6.5
Palpus	7.5

Third leg:	*Mm.*
First coxa	1.5
Second coxa	5.0
Third coxa	1.3
Femur	12.0
First tibia	15.25
Second tibia	21.5
Tarsus	2.25
Propodus	2.2
Terminal claw	1.1

Remarks.—In some ways this species is intermediate between *N. uniunguiculatum* and *N. albatrossi.* It has the large chela of *N. uniunguiculatum*, but with many more teeth, and the palpi of the two species are similar, although the fourth joint of *N. ohshimai* is somewhat shorter. However, it is much longer than the comparable joint in *N. albatrossi.* The structure of the compound spines of the oviger is closer to *N. albatrossi* than to *N. uniunguiculatum. N. ohshimai* appears to be a much larger species than either *N. uniunguiculatum* or *N. albatrossi*, to judge from this single male specimen, which is somewhat flabby.

The locality is southeast of Shikoku.

This species is named for Dr. Hiroshi Ohshima, former director of the Amakusa Marine Biological Laboratory, who has made several excellent contributions to the literature on the Pycnogonida.

NYMPHON NIPPONENSE, new species

FIGURE 32

Types.—Holotype (ovigerous male): U.S.N.M. No. 80592, *Albatross* station 4980, latitude 34°09′ N., longitude 137°55′ E., 507 fathoms, 39.0° F., September 1, 1906.

Paratypes (6 females, 5 males) : Same locality.

Additional collecting records.—*Albatross* stations 4960 (2 females) ; 4967 (1 male) ; 4975 (1 male) ; 4977 (1 male, 1 female).

Description.—Trunk moderately elongate, lateral processes separated by about their own diameter. Body smooth, without conspicuous spines or tubercles. Eye tubercle slightly higher than broad, bluntly

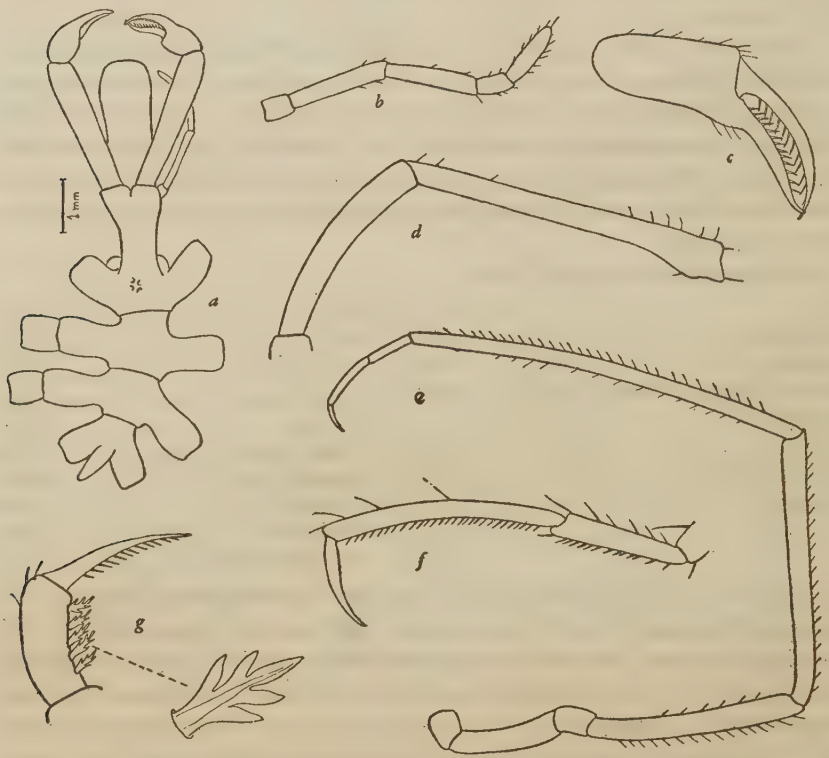

FIGURE 32.—*Nymphon nipponense*, new species: *a*, Dorsal view of holotype; *b*, palpus; *c*, chela; *d*, fourth and fifth joints of oviger; *e*, third leg; *f*, tarsus and propodus; *g*, terminal joint of oviger.

rounded and usually tilted slightly backward; eyes large, well developed.

Proboscis slightly longer than neck, cylindrical.

Abdomen short, papilliform, not much longer than last lateral processes.

Chelifore : Scape stout, about as long as proboscis ; chelae moderately long, slender, and curved, armed with large, well-separated teeth, 12 to 15 teeth on each finger.

Palpus rather short and thick, the fourth joint about half as long as the fifth.

Oviger: Fourth joint conspicuously shorter than fifth, arcuate but not strongly curved, fifth joint straight, club-shaped in both sexes, but somewhat more angular in the male and with several reversed spines toward the distal end. The compound spines of the oviger are large and coarse, with two or three pairs of large denticulations. Terminal claw somewhat longer than terminal joint, with about a dozen well-separated spinules. Formula of spines on terminal joints usually 11:6:6:5::12.

Third leg fairly robust, with fine setae on femoral and tibial joints. First and third coxae subequal, second coxae about as long as first and third together. Femur straight, shorter than first tibia. Second tibia longer than first. Propodus slightly more than half as long as tarsus, both joints with a row of close-set small spines along ventral surface. Terminal claw moderately heavy, fairly straight, about a third as long as the propodus. No auxiliary claws.

Measurements.—As follows:

	Mm.
Proboscis	2.5
Trunk	5.1
Second lateral process, width	3.25
Abdomen	.8
Scape	2.5
Chela	2.3
Palpus	2.75

Third leg:	*Mm.*
First coxa	0.6
Second coxa	2.0
Third coxa	.7
Femur	4.0
First tibia	5.0
Second tibia	7.75
Tarsus	1.1
Propodus	2.1
Terminal claw	.8

Remarks.—This species is separable from the other uniunguiculate species from Japanese waters on the basis of the short propodus, the small palpus, and smaller chela with its large, well-separated spinules. The conspicuously straight fifth joint of the oviger also appears to be characteristic. All the material was collected in moderately deep water off the southern coast of Honshu.

NOTES ON HILTON'S SPECIES OF NYMPHON

Before it was possible to make final determinations of the material from Japanese waters in this genus, it was necessary to examine the types of the several new species of *Nymphon* from the North Pacific proposed by Hilton (1942a), inasmuch as only brief diagnoses were given. Several of these have already been cited in the foregoing taxonomic discussion, but in order to clarify the status of all of them, brief comments and drawings of diagnostic characters are presented below. Only the material personally examined is cited.

NYMPHON PROFUNDUM Hilton

FIGURE 33, *a-f*

Nymphon profundum HILTON, 1942a, p. 3.

Collecting record.—Albatross station 4766, latitude 52°38′ N., longitude 174°49′ W., 1,766 fathoms, May 31, 1906, 1 female, holotype.

This is a uniunguiculate species, differing from those found in Japanese waters in the absence of an eye tubercle, which character it shares with *N. hamatum* Hoek and *N. procerum* Hoek (1881, see also Gordon,

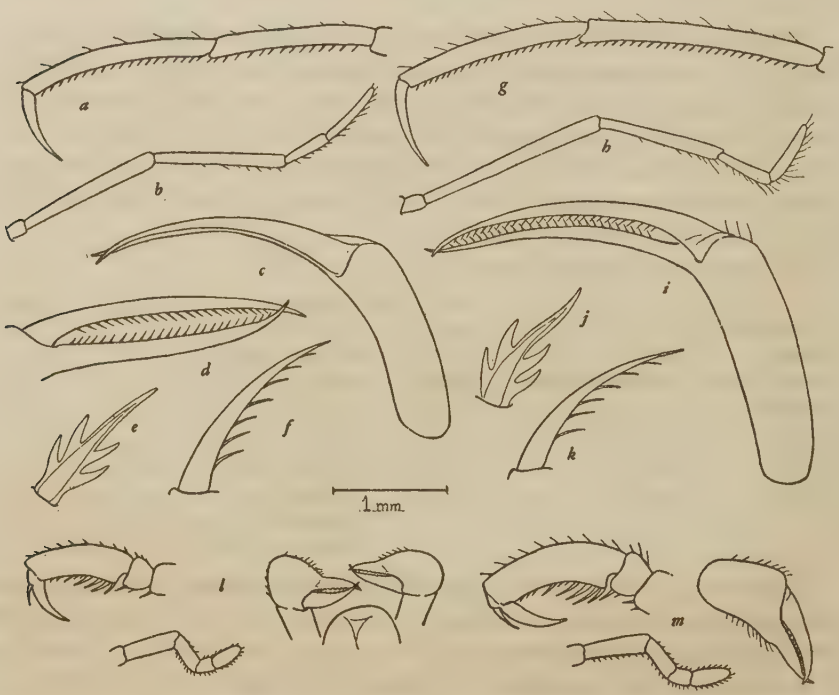

FIGURE 33.—*a-f, Nymphon profundum* Hilton; *g-k, Nymphon noctum* Hilton; *l, Nymphon duospinum* (Hilton); *m, Nymphon quadrispinum* (Hilton). *e-f, j, k,* greatly enlarged; all others to same scale, as indicated.

1932). In general appearance, and in the conformation of the compound spines of the oviger it resembles *N. hamatum* (*Challenger* stations 146 and 147, Indian Ocean south of Madagascar), but it lacks the projection on the ends of the femur of that species. Except for the fewer denticulations of its compound spines, *N. profundum* is almost identical with *N. procerum* (*Challenger* station 299, in the South Pacific west of Valparaiso). However, *N. profundum* differs from both of Hoek's species in the structure of the terminal claw of the oviger, which bears half a dozen long slender spines instead

of the wedgelike serrations of *N. hamatum* or the numerous close-set spines of *N. procerum*. *Nymphon procerum* and *N. profundum* are based on single female specimens.

NYMPHON NOCTUM Hilton

FIGURE 33, *g-k*

Nymphon noctum HILTON, 1942a, p. 3.

Collecting record.—*Albatross* station 2859, latitude 55°20′ N., longitude 136°20′ W., 1,569 fathoms, August 29, 1888, 1 ovigerous male, holotype; 1 female; 2 juveniles (paratypes).

With the exception of a longer tarsal joint, this species resembles *N. profundum* and differs from the two blind species described by Hoek in the same particulars as *N. profundum*. In the male specimen there are slight projections at the ends of the femurs, but this process is much less conspicuous than in *N. hamatum*. Except for the longer tarsus and a somewhat heavier investiture of setae, it is inseparable from *N. profundum*, and I do not believe these details are of specific importance. The fourth joint of the male oviger is broadly curved, somewhat less than one-half as long as the fifth, which is straight and narrowly clavate.

NYMPHON MOLUM Hilton

FIGURE 34, *a*

Nymphon molum HILTON, 1942a, p. 4.

Collecting record.—*Albatross* station 3439, latitude 57°06′ N., longitude 170°35′ W., 41 fathoms, August 3, 1891, 1 ovigerous male, holotype.

This species is characterized by a rather stout terminal claw and small auxiliaries, the lack of large spines on the propodus, and the rather simple spines of the oviger. These spines are smooth or bear but one pair of denticulations. The chelae are moderately long, armed with short teeth. The fourth and fifth joints of the oviger are subequal, straight, not conspicuously swollen distally.

NYMPHON VARIATUM Hilton

FIGURE 34, *b*

Nymphon variatum HILTON, 1942a, p. 4.

Collecting record.—*Albatross* station 4245, Kasan Bay, Prince of Wales Island, 95 to 98 fathoms, July 11, 1903, 1 female (?).

This species is based on a single specimen, probably a female, which is broken in half and lacks ovigers. Hence its exact status cannot be ascertained, but it appears to be close to if not identical with *N. pixellae* Scott.

NYMPHON OCULOSPINUM Hilton

FIGURE 34, *c*

Nymphon oculospinum HILTON, 1942a, pp. 4–5.

Collecting record.—*Albatross* station 3435, latitude 26°45′00″ N., longitude 110°45′20″ W., 859 fathoms, April 22, 1891, 1 male, holotype.

In view of the wide range of variation in the *grossipes-mixtum-*

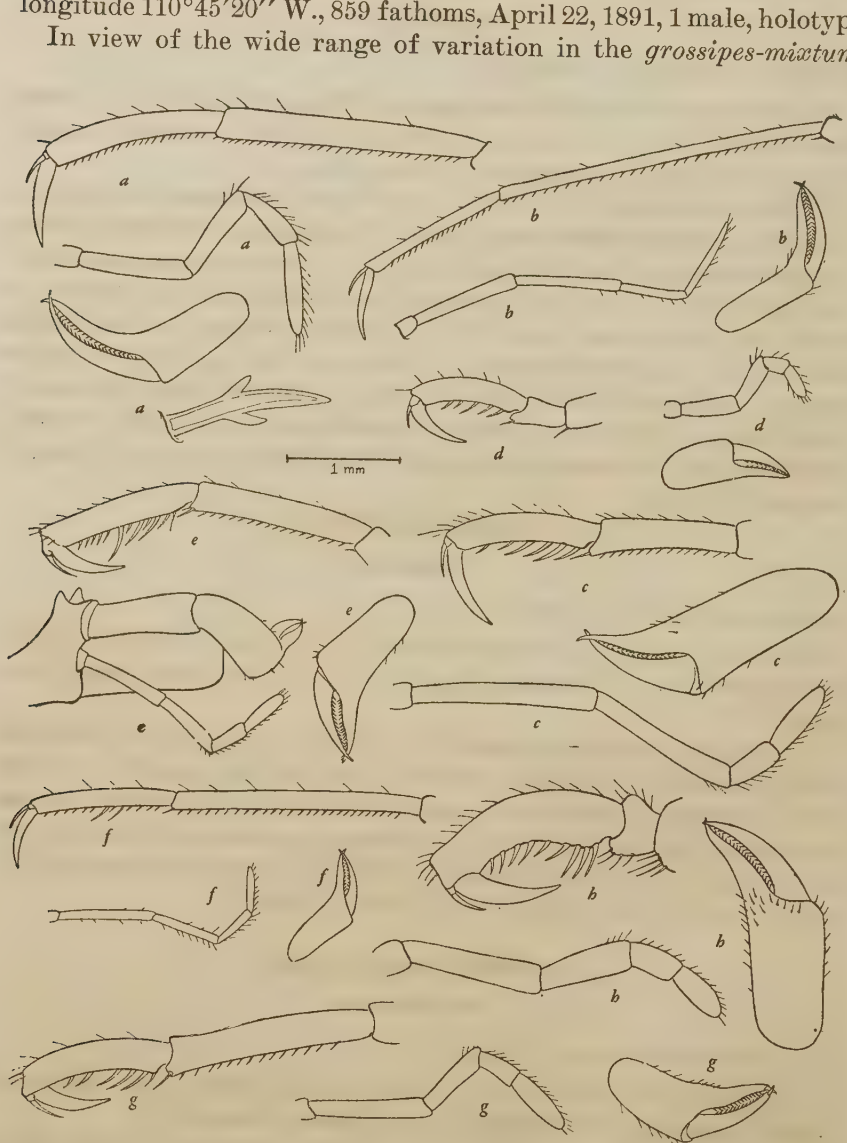

FIGURE 34.—*a*, *Nymphon molum* Hilton; *b*, *Nymphon variatum* Hilton; *c*, *Nymphon oculospinum* Hilton; *d*, *Nymphon microcollis* Hilton; *e*, *Nymphon basispinosum* Hilton; *f*, *Nymphon elongatum* Hilton; *g*, *Nymphon nigrognathum* Hilton; *h*, *Nymphon microsetosum* Hilton. All drawings to same scale, except denticulate spines of *N. nolum*.

glaciale group, this species cannot be clearly separated from that complex. The chela is somewhat larger than usual, and the record from 859 fathoms in the Gulf of California is puzzling. As a diagnostic character, Hilton describes the auxiliary claws as "more than half the length" of the terminal. I find them slightly less than half as long. The pointed eye tubercle is not a good character, as it is also found in specimens of *N. grossipes*, and the tip is easily broken off.

NYMPHON MICROCOLLIS Hilton

FIGURE 34, *d*

Nymphon microcollis HILTON, 1942a, p. 5.

Collecting record.—U.S.R.S. *Corwin*, "Alaska," 1885, 1 female (holotype).

The specimen described under this name does not appear to be separable from *Nymphon brevirostre* Hodge.

NYMPHON BASISPINOSUM Hilton

FIGURE 34, *e*

Nymphon basispinosum HILTON, 1942a, p. 5.

Collecting record.—*Albatross* station 4788, latitude 54°50′24″ N., longitude 167°13′ E., 57 fathoms, June 12, 1906, 1 ovigerous male (holotype).

The prominent conical projections or tubercles over the bases of the chelifores makes this a well-characterized species. In this respect it somewhat resembles *N. striatum* Losina-Losinsky, from which it differs principally in the possession of large spines on the propodus. The designation of the type specimen as a female is evidently a *lapsus calami*: the specimen is an ovigerous male. The long joints of the oviger are subequal, straight.

NYMPHON ELONGATUM Hilton

FIGURE 34, *f*

Nymphon elongatum HILTON, 1942a, p. 5.

Collecting record.—*Albatross* station 4792, latitude 54°36′15″ N., longitude 166°57′15″ W., 72 fathoms, June 14, 1906, 2 males, 1 female, cotypes.

Inasmuch as all three specimens have rather delicate toothed chelae, the diagnosis of "heavy jaws, no teeth" must be revised. The most important diagnostic character is the presence of two large spines near the middle of the propodus. The tarsus is twice as long as the propodus. In one specimen the lateral processes are separated by at least four times the diameter, but the others are less widely separated. The fourth joint of the male oviger is slightly curved, not quite as much as the fifth, which is straight and slightly expanded distally.

NYMPHON NIGROGNATHUM Hilton

FIGURE 34, *g*

Nymphon nigrognathum HILTON, 1942a, p. 6.

Collecting record.—*Albatross* station 2864, latitude 48°22′ N., longitude 122°51′ W., 48 fathoms, September 6, 1888, 1 ovigerous male, holotype.

This species cannot be clearly separated from the *grossipes-mixtum-glaciale* complex. Hence I regard it as a synonym of *N. grossipes*.

NYMPHON MICROSETOSUM Hilton

FIGURE 34, *h*

Nymphon microsetosum HILTON, 1942a, p. 6.

Collecting record.—*Albatross* station 4777, latitude 52°11′ N., longitude 179°49′ E., 43–52 fathoms, June 4, 1906, 2 specimens, cotypes.

The presence of short stiff setae over the trunk, scape, and proximal joints of the legs characterizes this species. The combination of rather large size and very short tarsus is not common in this genus. The fourth and fifth joints of the oviger are straight, subequal.

NYMPHON DUOSPINUM (Hilton)

FIGURE 33, *l*

Chaetonymphon duospinum HILTON, 1942a, p. 6.

Collecting record.—Kiska Harbor, Alaska, 10 fathoms, 1873, W. H. Dall collector, 1 female ?, holotype.

According to the diagnosis this species has but two basal spines on the propodus. This is not so. As can be seen from the figure there are at least four, as in the following species. Except for the compact trunk this species is closely related to *N. microsetosum* Hilton.

NYMPHON QUADRISPINUM (Hilton)

FIGURE 33, *m*

Chaetonymphon quadrispinum HILTON, 1942a, p. 7.

Collecting record.—Kiska Harbor, Alaska, 19 fathoms, 1873, W. H. Dall collector, 1 female ?, holotype.

There is no substantial difference between the two specimens designated as types for *Chaetonymphon duospinum* and *quadrispinum*, except that the latter specimen is somewhat larger and more intact.

Family PALLENIDAE Wilson, 1878

The author agrees with Marcus (1940, p. 128) that it is not necessary to change this family name although *Pallene*, the type genus, is a preoccupied name and has been replaced by *Callipallene* Flynn (1929). This usage has been explained in a previous paper (1948, pp. 199–201) and finds support in the views expressed by Berg in his "Classification of Fishes" (1947, p. 354), who prefers the family names that have received wide usage in ichthyology.

The Pallenidae are represented in Japanese waters by two species of *Callipallene*, four of *Pallenopsis*, and one of *Propallene*. Loman (1911, p. 13) reported a "Pallenopsis n. sp?" from Sagami Bay, which unfortunately was not figured. He remarked upon its similarity to *Pallenopsis fluminensis*, and it evidently represents still another species of this genus in Japanese waters, but it is probably not identifiable with *P. fluminensis*.

The interesting little *Decachela discata*, described from Pacific Grove by Hilton (1942c) was taken by the *Albatross* west of Hokkaido. It does not, in my opinion, deserve unique family status, although its structure suggests a transition between the Pallenidae and Tanystylidae. Its oviger is of the typical pallenid type.

Genus CALLIPALLENE Flynn, 1929

Represented in Japanese waters by *Callipallene amaxana* (Ohshima), taken in pelagic tows at night, and by *C. dubiosa*, which may be closely related to *C. novo-zealandae* (Thomson). *Callipallene amaxana* differs from the latter species in having no auxiliary claws.

CALLIPALLENE DUBIOSA, new species

FIGURE 35

Paratypes (2 females).—U.S.N.M. No. 80577, *Albatross* shore trip, Hakodate, July 3, 1906.

Description.—Trunk close set but not compact, segmentation complete, lateral processes well separated, slightly longer than broad. Neck a narrow constriction separating trunk and base of chelifores. Eye tubercle rounded, about twice as high as broad. Eyes distinct but lightly pigmented.

Proboscis shaped somewhat like the small end of an egg, not quite twice as long as width at base.

Chelifore scape curved, heavy, twice as long as broad. Chelae rounded at base, with flat, close-set jaws with serrated opposing edges.

Third leg rather short for this genus, second tibia markedly longer than the first. Femur distended. Propodus thick-set, curved, with

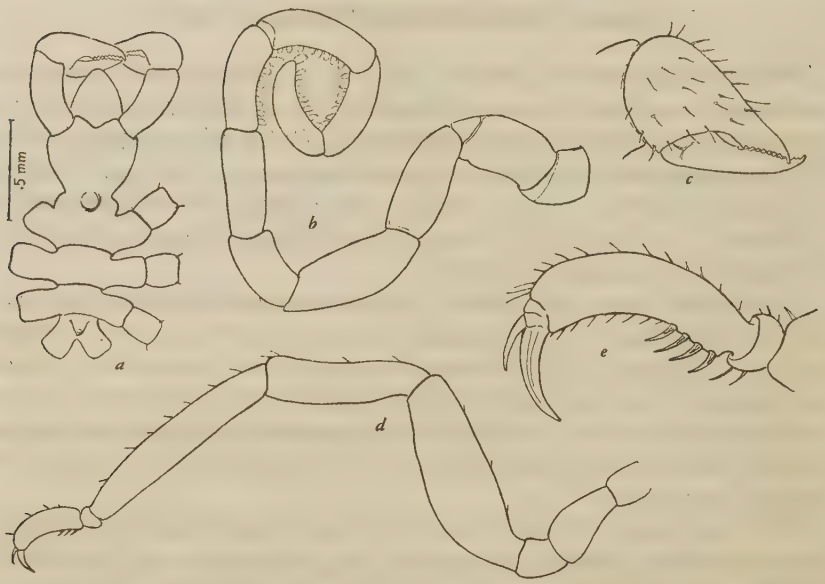

FIGURE 35.—*Callipallene dubiosa*, new species: *a*, Dorsal view of trunk; *b*, oviger; *c*, chela; *d*, third leg; *e*, tarsus and propodus.

four large basal spines. Terminal claw less than half as long as propodus, auxiliaries about half as long as terminal claw.

Oviger joints all somewhat short, four terminal joints bearing seven or eight flat denticulated spines on each joint.

Measurements.—As follows:

	Mm.
Length of proboscis	0.3
Length of trunk	1.1
Second lateral process, width	.7
Length of scape	.3
Chela	.5

Third leg:	Mm.
First coxa	0.2
Second coxa	.4
Third coxa	.25
Femur	1.1
First tibia	.75
Second tibia	1.1
Tarsus	.1
Propodus	.6
Terminal claw	.25
Auxiliary claw	.1

Remarks.—The closest relative of this species appears to be *Callipallene novo-zealandae* (Thomson, 1884), which is described as having "narrow, slightly curved" chelae. The chelae of *C. dubiosa* are rather robust, with comparatively heavy, straight fingers. The New Zealand species is figured with large slender spines on the propodus and an investiture of rather long setae, whereas this Japanese form has four

large spines and not so many large setae on the propodus. In general appearance *Callipallene dubiosa* also resembles *C. pectinata* (Calman, 1923), but it lacks the peculiar pectinate auxiliary claws of that species. Calman's specimen was a male, however, and both these specimens are females. If this character proves to be a sexual one, it may be necessary to consider the two species identical.

Genus PALLENOPSIS Wilson, 1881

PALLENOPSIS MOLLISSIMA (Hoek)

FIGURE 36, *f*

Phoxichilidium mollissimum HOEK, 1881, pp. 87–88, pl. 13, figs. 6–9.
Pallenopsis mollissima SCHIMKEWITSCH, 1893, pp. 41–42, pl. 2, fig. 24.

Collecting records.—Albatross stations 4975 (1 ovigerous male, 1 female); 5080 (1 female).

This species was described from a single incomplete specimen from *Challenger* station 237, latitude 34°37′ N., 140°32′ E., 1,875 fathoms, which was without tarsi. The description was completed by Schimkewitsch (1893), who examined a specimen taken by the *Albatross* in the eastern Tropical Pacific, at station 3360.

Evidently the range of this species comprises the deeper waters of the North Pacific, between latitudes 6° and 35° N. Both the Japanese records are off southern Honshu.

PALLENOPSIS TYDEMANI Loman

FIGURE 36, *i*, *j*

Pallenopsis tydemani LOMAN, 1908, pp. 65–66, pl. 10, figs. 139–145.

Collecting record.—Albatross station 4908 (1 female).

Previously reported by Loman from *Siboga* stations 45 and 314, 794 and 694 meters. The stations are both north of Soembawa, in the Dutch East Indies, and this record extends the range to southwest of Honshu.

PALLENOPSIS VIRGATUS Loman

FIGURE 36, *g*, *h*

Pallenopsis virgatus LOMAN, 1908, pp. 69–70, pl. 9, figs. 135–136.

Collecting record.—Albatross station 3730 (1 male).

Described by Loman from *Siboga* station 310, latitude 8°30′ S., longitude 119°7.5′ E., 73 meters. It is evidently a shallow-water

species. Loman's figure indicates the presence of small tubercles on the dorsal margin of the first coxae. I find these present, usually in pairs, on this specimen.

PALLENOPSIS STYLIROSTRE, new species

FIGURE 36, *a–e*

Types.—Holotype (male); U. S. N. M. No. 80554, *Albatross* station 4975, latitude 33°21′30″ N., longitude 135°38′50″ E., 545–712 fathoms, 37.5°, August 31, 1906.

Paratype (ovigerous male): *Albatross* station 4970, latitude 33°23′30″ N., 135°36′30″ E., 500–649 fathoms, 39.1°, August 30, 1906.

Description.—Trunk oval in outline, segmentation well marked, lateral processes separated by about their own width. Eye tubercle slightly higher than wide, roundly pointed at posterior end, the eyes unequal in size.

Proboscis about as along as trunk, pointed downward, broadly styliform, blunt at tip.

Chelifore: Scape 2-jointed, long and slender but not quite as long as proboscis. Chelae small, rounded, with small curved pincers without spines or denticulations.

Abdomen about three times as long as broad, rounded at tip.

Third leg long, slender, straight, without prominent tubercles, processes, or spines, Propodus small, with two or three large basal spines, and several broad wedge-shaped spines on the sole. Terminal claw almost as long as propodus, auxiliaries about one-fifth as long as terminal claw.

Oviger of the usual recurved type in the genus, with the sixth segment markedly curved. The terminal segments are adorned with long slender spines.

Measurements.—As follows:

	Holotype, ♂ Mm.	*Paratype, ♂ Mm.*
Proboscis	3.9	4.1
Trunk	4.5	5.0
Second lateral process, width	2.25	3.4
Abdomen	1.25	2.0
Scape		3.7
Third leg:		
First coxa	1.0	1.5
Second coxa	2.5	3.5
Third coxa	1.0	1.5
Femur	6.0	9.0
First tibia	6.9	9.5
Second tibia	7.25	11.5
Tarsus and propodus	1.4	1.6

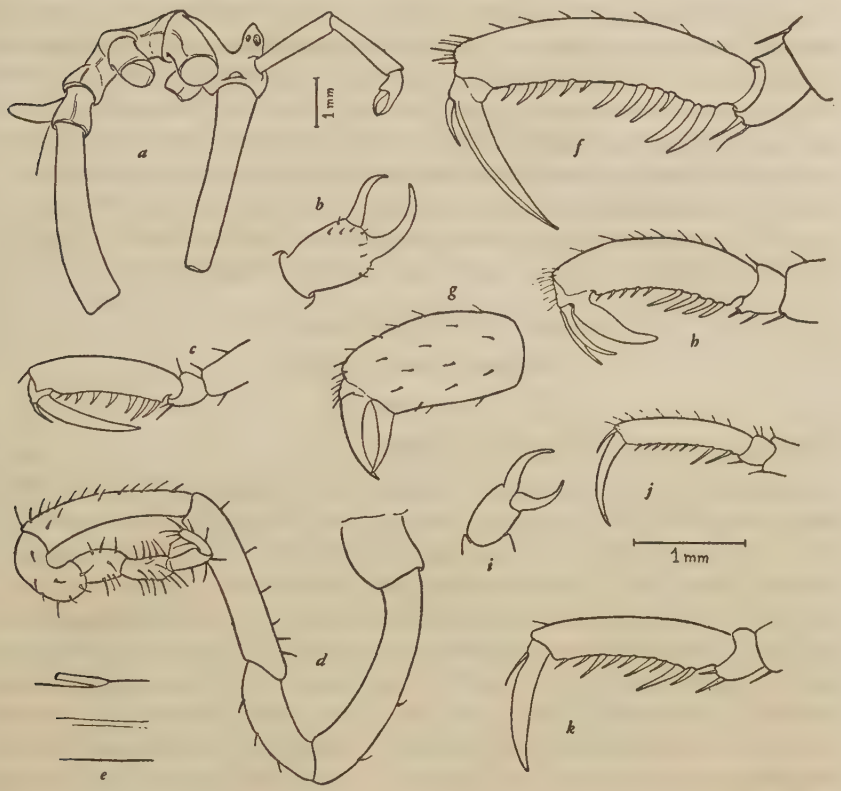

FIGURE 36.—*a-e*, *Pallenopsis stylirostre*, new species: *a*, Lateral view, paratype; *b*, chela; *c*, tarsus and propodus; *d*, oviger; *e*, femoral cement gland. *f*, *P. mollissima* (Hoek): Tarsus and propodus. *g*, *h*, *P. virgatus* Loman: *g*, Chela; *h*, tarsus and propodus. *i*, *j*, *P. tydemani* Loman: *i*, Chela; *j*, tarsus and propodus. *k*, *P. profunda* Hilton: Tarsus and propodus.

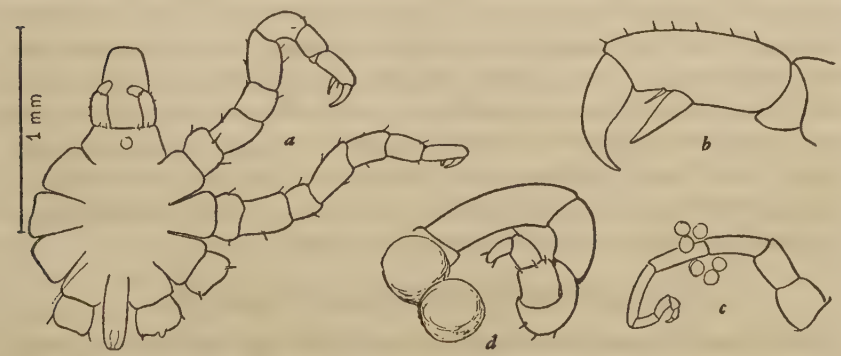

FIGURE 37.—*Decachela discata* Hilton (holotype): *a*, Dorsal view; *b*, tarsus and propodus; *c*, oviger; *d*, detail of oviger.

Remarks.—This species bears a superficial resemblance to *P. tydemani* in its general appearance and the conformation of the proboscis, but it has a well-developed eye tubercle with functional eyes, and the propodus is much shorter, with heavier spines on the sole than *P. tydemani*. Hilton's (1942c) *Pallenopsis profunda* from the Bering Sea has a similar proboscis, but the structure of the propodus is different and it is much larger in proportion to the size of the animal (fig. 36, *k*). This species appears to be a deep-water form of the subtropical latitudes, as both Japanese records are off southern Honshu.

Genus DECACHELA Hilton, 1939

DECACHELA DISCATA Hilton

FIGURE 37

Decachela discata HILTON, 1939a, p. 34; 1942e, p. 70.

Collecting record.—*Albatross* station 4987, latitude 43°19′20″ N., longitude 140°17′ E., 59 fathoms, August 20, 1906, 44.8° F., 1 female.

This specimen shows no significant differences from the holotype specimen, from which the accompanying figures were drawn. As can be seen from these figures, the chelate structure on which Hilton based the family Decachelidae is actually a modified basal spine of the propodus and the legs are eight-jointed instead of "apparently seven jointed." Apparently this small form has been overlooked, for its occurrence in both Japan and California suggests a wide distribution along the shores of the North Pacific. This record is off the west coast of Hokkaido.

Family PHOXICHILIDIIDAE Sars, 1891

Although this family is not well represented in Japanese waters, there are a number of interesting forms which cause more confusion than light shed on the status of the genera involved. The differences between *Phoxichilidium* and *Anoplodactylus* are tenuous enough, and the occurrence of two species that would probably be referred to *Anoplodactylus* by some taxonomists, but which possess well-developed auxiliary claws and incompletely segmented ovigers, characters associated with *Phoxichilidium*, opens questions concerning the validity of *Anoplodactylus* as an independent genus. A critical examination of this problem must await more material, however.

Genus PHOXICHILIDIUM Milne-Edwards, 1840

This genus is represented in Japanese waters by two hitherto undescribed species; the ubiquitous *Phoxichilidium femoratum* of the North Atlantic and Northeastern Pacific is so far unreported from this

region. *Phoxichilidium* is characterized by a 5- or 6-jointed oviger, the possession of auxiliary claws, and, in comparison with *Anoplodactylus*, a relatively shorter dorsal prolongation of the cephalic segment and a correspondingly less ventral origin of the proboscis. In the two species described below, however, this character of the cephalic segment is closer to *Anoplodactylus* than to the other species of *Phoxichilidium;* hence I should further characterize *Anoplodactylus* by the possession of a localized femoral cement gland in the male, although this is not always present. In both of these species the cement gland is represented by a row of pores along the dorsal surface of the femur.

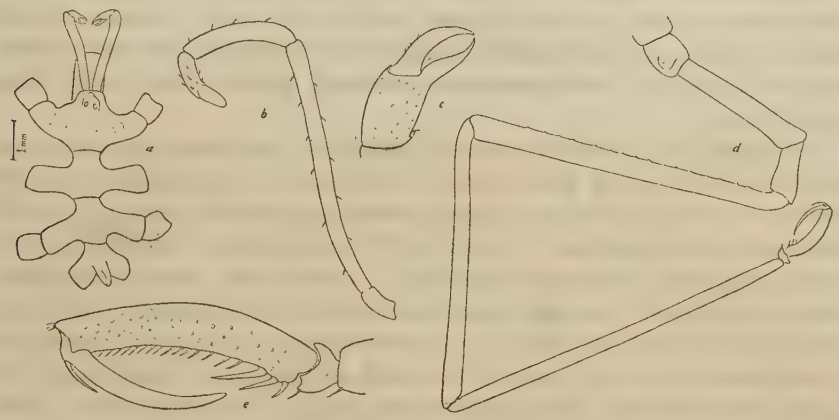

FIGURE 38.—*Phoxichilidium ungellatum*, new species: *a*, Dorsal view of trunk; *b*, termina joints of oviger; *c*, chela; *d*, third leg; *e*, tarsus and propodus.

PHOXICHILIDIUM UNGELLATUM, new species

FIGURE 38

Types.—Holotype (male): U.S.N.M. No. 80542, *Albatross* station 4842, latitude 36°13′ N., 133°27′ E., 82 fathoms, 54.6° F. July 26, 1906.

Paratypes (4 females, 1 ovigerous male): Same locality.

Additional collecting records.—Albatross stations 4803 (1 female); 4826 (1 male); 4891 (1 ovigerous male); 4958 (1 female); 4969 (1 female); 4973 (1 male); 5079 (3 females); 5080 (1 female).

Description.—Trunk oval in outline, completely segmented, lateral processes well separated by about their own diameter. Without tubercles, processes, or spines. Eye tubercle rounded to sharply pointed, two to three times as tall as width at base, with large well-developed eyes.

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Proboscis cylindrical, blunt at tip, with a slight constriction near distal third, inserted ventrally at about the middle of the cephalic segment.

Chelifore: Scape long, slender, curved. Chelae small, with curved, opposing fingers which are without spines or teeth on the inner surface. There is a low inconspicuous spiny cushion on the dactylus, with short spines sparsely scattered on its surface.

Abdomen erect, about twice as long as wide, rounded at tip.

Oviger inserted on first lateral process about halfway from center of cephalic segment. The third segment is long and relatively straight, with a slight curve proximally. There is an incomplete, nonarticulated segmentation near the base. Fourth segment about five times as long as wide, curved, with a few small spines. Fifth segment with a nonarticulated segmentation near the middle; proximal half adorned with scattered recurved spines, distal half bare, palpiform.

Third leg long, slender, straight, without prominent spines or tubercles. First coxae short, about as broad as long, third coxa one and one-half times as long as first, second nearly twice as long as both first and third together. Femur and tibiae straight, sticklike, without conspicuous spines or tubercles. Tarsus very short, propodus long, curved, with two very large basal spines and a smaller one on the corner of the heel, and about 15 smaller spines on the sole. Terminal claws three-fourths or four-fifths as long as propodus, slightly curved. Auxiliaries slender, about one-fifth as long as terminal claw. The genital pore of the female was apparent on a low mound of the first coxae: I could not find it on any of the other legs. In the male it occurs on the last two pairs of legs as a low tubercle on the first coxae. There is a row of 15 or more small pores on the dorsal surface of the femur, indicating the apertures of the cement glands.

Measurements.—As follows:

	Mm.	Third leg:	*Mm.*
Proboscis	2.75	First coxa	1.0
Trunk	4.75	Second coxa	4.0
Second lateral process, width	3.2	Third coxa	1.6
Scape	2.75	Femur	8.0
Chela	1.0	First tibia	8.0
Abdomen	.8	Second tibia	9.0
		Tarsus	.2
		Propodus	1.9
		Terminal claw	1.25
		Auxiliary claw	.3

Remarks.—Although this material establishes a rather wide bathymetric range (82–587 fathoms) for this species, I could see no significant difference between the specimens from various depths. The num-

ber of spines on the base of the propodus is apparently variable; in some specimens there are four. The color varied, in alcohol, from light straw to a bright reddish brown. The distribution, according to these collections, is from north of Hokkaido to west of Kyushu, and south of Honshu. The southern stations are in deeper water.

This species closely resembles *Phoxichilidium micropalpidum* Hilton (1942f, p. 72), described from *Albatross* station 4792, latitude 54°36′15″ N., longitude 166°57′15″ E., 72 fathoms. It differs from this species in having a longer femur with 15 instead of 5 femoral pores, in having a longer third joint of the oviger, and in having auxiliary claws less than a third as long as the terminal claw, whereas those of Hilton's species are half as long.

PHOXICHILIDIUM HORRIBILIS, new species

FIGURE 39

Types.—Holotype (male): U.S.N.M. No. 80538, *Albatross* station 4803, latitude 46°42′ N., longitude 151°45′ E., 229 fathoms, 35.9° F., June 24, 1906.

Paratype (ovigerous male): Same locality.

Description.—Trunk oval in outline, completely segmented, lateral processes separated by slightly more than their own diameter. There are no tubercles, processes, or spines on the trunk or lateral processes. Eye tubercle bluntly conical, with four well-developed eyes about midway between base and tip.

Proboscis blunt at tip, constricted near distal third, not quite as long as trunk.

Chelifore: Scape straight, moderately heavy, about as long as the chela. Chela large, arcuate or scythe shaped, with a row of 15 or 20 large, long teeth on each finger.

Abdomen erect, small, rounded at tip.

Oviger inserted ventrally near the base of the lateral process instead of halfway out. Third segment broadly arched, with a nonarticulated constriction near the base. Fifth segment with a nonarticulated constriction near the middle, the basal half with a few recurved spines, distal half palpiform, bare.

Third leg moderately long, without conspicuous spines or tubercles. The second coxa is about as long as the first and third together, but the first coxa is less than half as long as the third. Tarsus short, propodus heavy, strongly curved, with a conical projection at the end. There are four large basal spines on the heel, a pair of shorter spines near the middle of the sole, and a double row of small spines along the sole, with a somewhat larger spine at the distal end of the row. Terminal claw heavy, curved, about half as long as propodus; auxiliaries about half as long as terminal claw. Genital pore on midventral surface

of second coxa. Femoral cement gland openings a row of 7 to 8 small pores along dorsal surface of femur.

Measurements.—As follows:

	Mm.
Proboscis	ca. 2.25
Trunk	4.0
Second lateral process, width	2.4
Scape	1.9
Chela	ca. 1.8

Third leg:	Mm.
First coxa	0.6
Second coxa	2.25
Third coxa	1.4
Femur	4.0
First tibia	3.4
Second tibia	4.6
Tarsus	.25
Propodus	1.5
Terminal claw	.7
Auxiliary claw	.4

Remarks.—The large conspicuous chelae separate this species from any other in the family, as well as in the genus, and suggest the proposed specific name. The locality is the southern Sea of Okhotsk just north of the Kurile chain.

Genus ANOPLODACTYLUS Wilson, 1878

ANOPLODACTYLUS GESTIENS (Ortmann)

FIGURE 40, *a–d*

Phoxichilidium gestiens ORTMANN, 1891, p. 166, pl. 24, fig. 8.
Anoplodactylus gestiens LOMAN, 1911, p. 13.
?*Anoplodactylus gestiens* OHSHIMA, 1933c, p. 219.
Anoplodactylus gestiens OHSHIMA, 1936, p. 864.

Collecting records.—*Albatross* stations 3703 (1 female); 3715 (1 female); 3739 (1 ovigerous male).

The cement gland opening in this species is an inconspicuous tubular process about midway on the dorsal surface of the femur. The origin of the ovigers is well out on the first lateral process, as in *A. typhlops* Sars and *A. neglectus* (Hoek).

ANOPLODACTYLUS species

FIGURE 40, *e–g*

Collecting records.—*Albatross* stations 5075 (1 female); 5078 (1 female).

Both specimens appear to be the same species, in spite of the large difference in depth from which they were taken. Their nearest relative appears to be the western Atlantic *A. lentus* Wilson, but the chelae are somewhat straighter and heavier than in *A. lentus*, and there is no vestige of an auxiliary claw as in Wilson's species. In the absence of male specimens it cannot definitely be referred to any

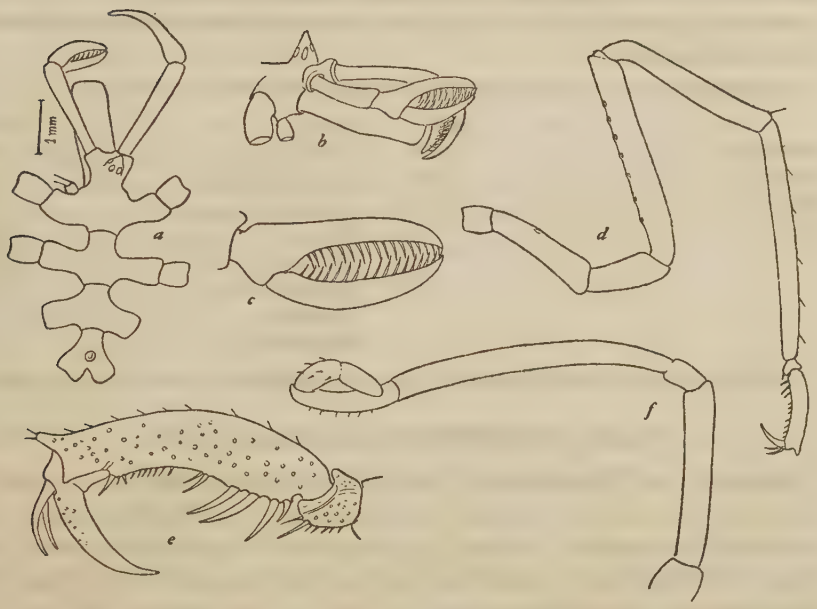

FIGURE 39.—*Phoxichilidium horribilis*, new species: *a*, Dorsal view of holotype; *b*, lateral view of anterior end; *c*, chela; *d*, third leg; *e*, tarsus and propodus; *f*, oviger.

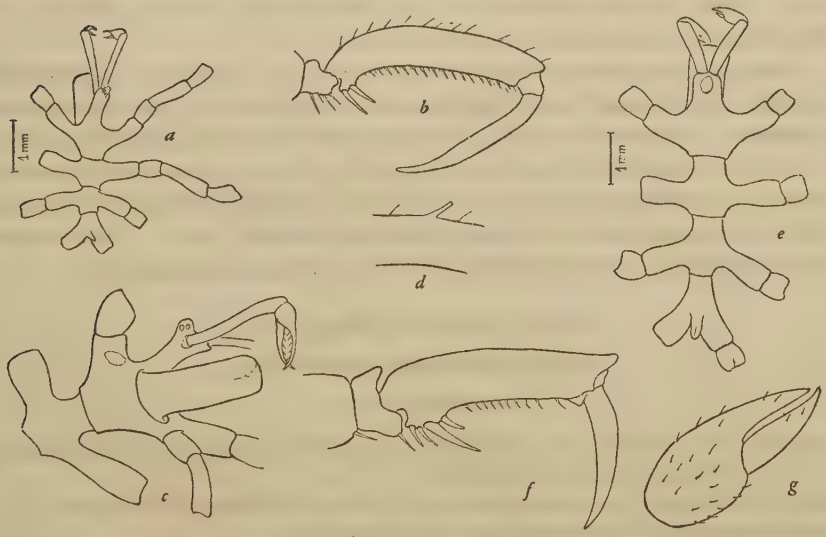

FIGURE 40.—*a-d*, *Anoplodactylus gestiens* Ortmann: *a*, Dorsal view of trunk; *b*, tarsus and propodus; *e*, lateroventral view of anterior end; *d*, femoral cement gland of male. *e-g*, *Anoplodactylus* sp.: *e*, Dorsal view of trunk; *f*, tarsus and propodus; g, chela.

particular species, however, as there are no salient characters by which it can be identified. It is a large form, as can be seen by the specimen from station 5075.

Measurements.—As follows (specimen from station 5075):

	Mm.		Mm.
Proboscis	3.5	Third leg:	
Trunk	6.0	First coxa	ca. 1.0
Second lateral process, width	4.6	Second coxa	2.0
Scape	.5	Third coxa	.8
		Femur	14.5
		First tibia	12.5
		Second tibia	17.5
		Tarsus	----
		Propodus	----

Both localities from which this form was taken are south of Honshu.

Family AMMOTHEIDAE Dohrn, 1881

Inasmuch as *Nymphonella tapetis*, for which Ohshima (1938) erected a new family, is actually an aberrant *Ascorhynchus*, I believe it should be retained in the Ammotheidae. It evidently owes its structural differences (which are confined to the anterior end, specifically the first pair of legs and the palpus), to its parasitic habit. If any specimens of this peculiar pycnogonid were collected by the *Albatross*, they must still be inside clam shells, for clams seem to be its preferred host. The adults, however, have been found free-living in sand. For further information on the history of this species, see Ohshima's various papers and Arita (1937).

Although this parasitic species is so far known only from Japan, it is possible that it may be of wider occurrence and will be discovered elsewhere. It would seem logical to expect it on the California coast.

The taxonomic relationship of *Nymphonella* to *Ascorhynchus* would seem to be confirmed by the occurrence of six species of *Ascorhynchus* in or near Japan, most of them in or near Sagami Bay. This is more than have been found anywhere else in as restricted a locality.

Genus ACHELIA Hodge, 1864

ACHELIA BOREALIS (Schimkewitsch)

FIGURE 41, *h–m*

Ammothea borealis SCHIMKEWITSCH, 1895, pp. 36–40, pl. 2, figs. a–b; 1907, pp. 5–9, pl. 1; 1930, pp. 139–144, figs. 34–37.
Ammothea borealis var. *japonica* LOSINA-LOSINSKY, 1933, pp. 57–59, fig. 9.
Achelia borealis HEDGPETH, 1947, pp. 24, 27, fig. 13b.

Collecting record.—*Albatross* station 5037, latitude 42°02′40″ N., longitude 142°33′20″ E., 175–349 fathoms, October 1, 1906, 37.9° F., 1 ovigerous male.

The general appearance of this animal, together with the long slender propodus and moderately spiny legs, places it close to this species, although Schimkewitsch's figures leave much to be desired.

This specimen is a curious abnormality, with three legs on the right side and four on the left (fig. 41, *h*). The larger distal end of the middle lateral process suggests a limb bud or rudimentary socket for the missing leg. There is no evidence that this is a result of regeneration after an injury. This and other abnormalities are discussed in more detail in another paper (Hedgpeth, 1947).

The locality for this collection is near the southern coast of Hokkaido.

ACHELIA PRIBILOFENSIS (Cole)

Ammothea pribilofensis Cole, 1904, pp. 270–273, pl. 12, fig. 6; pl. 18, figs. 7, 8; pl. 19, figs. 1–8.

Ammothea (*Achelia*) *pribilovensis* Schimkewitsch, 1930, pp. 156–160, figs. 46–49.

Collecting record.—*Albatross* shore trip, Milne Bay, Simushiru, June 23, 1906, 2 females.

This record of two females, one a full-grown mature specimen, extends the range of this species from the Pribilofs to the central Kuriles.

ACHELIA SUPERBA (Loman)

Ammothea superba Loman, 1911, pp. 11–12, pl. 1, figs. 14–15; pl. 2, figs. 16–24.—Ohshima and Kishida, 1947, p. 1008, fig. 2860.

Collecting records.—*Albatross* station 5021, latitude 48°32′30″ N., longitude 145°07′30″ E., 73 fathoms, September 27, 1906, 30.9°, 1 female.

This specimen falls well with the bathymetric range of 80–150 meters established by Loman.

ACHELIA BITUBERCULATA, new species

Figure 41, *a–g*

Holotype (*male*): U.S.N.M. No. 80575, Misaki, Sept. 1, 1929. Corallines.

Description.—Trunk compact, disk-shaped, segmentation not marked, lateral processes touching. At the anterior corner of each lateral process is a pair of small tubercles which appear to be fused at the base, and on the posterior corner there is a larger, single tubercle. There are small spines at the apices of each tubercle. The eye tubercle is tall and slender, with well-marked eyes near the summit. There are two dorsal trunk tubercles, about half the diameter of the eye tubercle and about the same height. The second tubercle rises immediately anterior to the origin of the abdomen. The integument is granular, heavily pigmented; color deep brown.

Proboscis as long as the trunk, broadly oval.

Chelifore one-third as long as proboscis, with a globular subchela.

Palpus slightly longer than proboscis, the four terminal joints with ventral lobes, giving it a serrate appearance.

Abdomen slender, fingerlike, slightly dilated toward the distal third, reaching to end of the first coxae. It is adorned with a few sets of short spines.

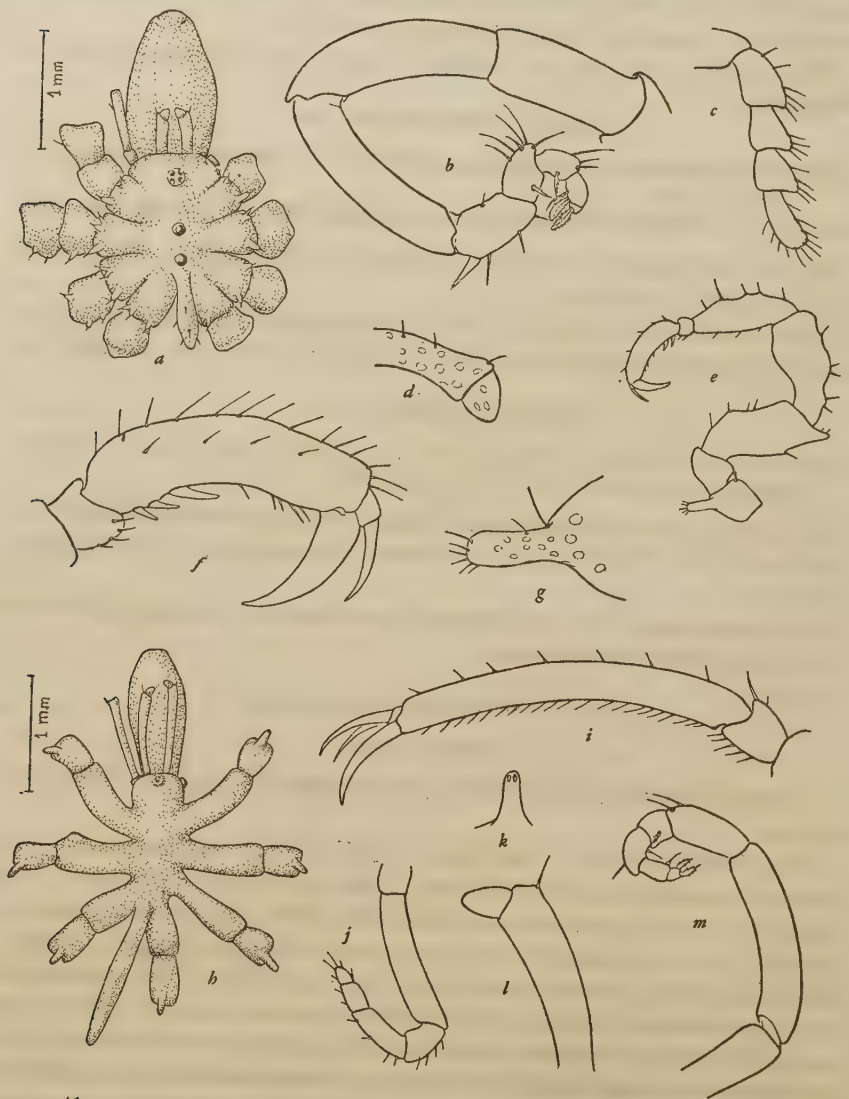

FIGURE 41.—*a-g*, *Achelia bituberculata*, new species: *a*, Dorsal view of holotype; *b*, oviger; *c*, terminal joints of palpus; *d*, chelifore; *e*, third leg; *f*, tarsus and propodus; *g*, genital protuberance. *h-m*, *A. borealis* (Schimkewitsch): *h*, Dorsal view; *i*, tarsus and propodus; *j*, palpus; *k*, eye tubercle; *l*, chelifore; *m*, oviger.

Third leg short, knobby and spinose. The genital process is on the ventral distal corner of the second coxae of the last two pairs of legs, about two-thirds as long as the width of the coxal joint. There is a tuft of short heavy spines at the tip. Tarsus short, propodus curved, with three large spines on heel. Terminal claw broad, half as long as propodus. Auxiliary claw more than half as long as terminal claw.

Oviger rather heavy, 9-jointed, with a heavy reversed spine at the base of the sixth segment, a tuft of long spines on the outer distal edge of the seventh, and two denticulate spines on the eighth segment, three on the ninth.

Measurements.—As follows:

	Mm.
Proboscis	1.25
Trunk	1.50
Second lateral process, width	1.4
Abdomen	.6

Third leg:	*Mm.*
Coxae	1.0
Femur	1.0
First tibia	.98
Second tibia	.8
Tarsus	.1
Propodus	.75
Terminal claw	.4

Remarks.—This species appears to be close to *A. litke* Losina-Losinsky but differs from that species in having dorsal trunk tubercles. Other species with tall dorsal trunk tubercles are *A. assimilis* (Haswell) and *A. wilsoni* (Schimkewitsch), from which it differs in the possession of the peculiar birfurcate tubercles on the anterior corners of the lateral processes.

ACHELIA species

Albatross shore trip, Milne Bay, Shimushiru, June 23, 1906, 1 immature.

This appears to be the immature form of one of the compact spinose species. The fingers of the chelae are straight and the specimen differs in other respects from the immature form from the Kuriles ascribed by Ohshima to *A. alaskensis.* It may be the Oriental or Japanese variety of *A. echinata.*

Genus AMMOTHELLA Verrill, 1900

AMMOTHELLA PROFUNDA, new species

FIGURE 42

Holotype (female).—U.S.N.M. No. 80567, *Albatross* station 5083, latitude 34°04′20″ N., longitude 137°57′30″ E., 624 fathoms, 38.1° F., October 20, 1906.

Description.—Trunk oval in outline, segmentation not marked by suture lines; the lateral processes diverging. Integument lightly

granular, without any knobs, tubercles, or processes. There is a small spine at the anterior and posterior corners of the lateral processes. Eye tubercle erect, leaning forward, bluntly pointed, without eyes.

Proboscis as long as trunk, bluntly ovoid, directed downward.

Chelifore somewhat more than half as long as proboscis, with conspicuous spines on the scape. Chela rudimentary, with small processes instead of fingers.

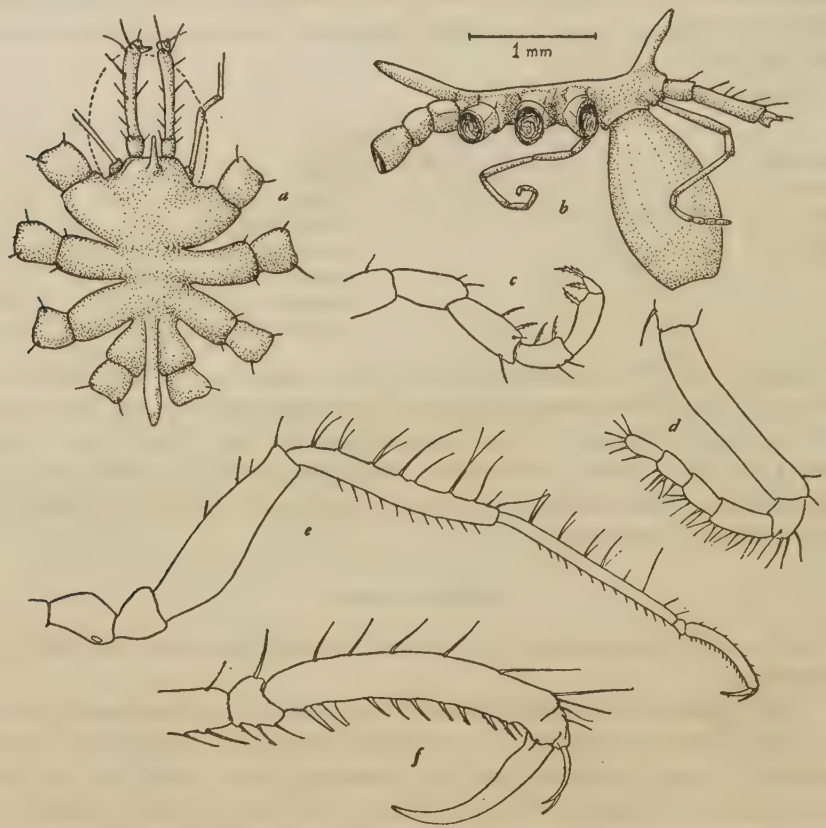

FIGURE 42.—*Ammothella profunda*, new species: *a*, Dorsal view of trunk; *b*, lateral view; *c*, terminal joints of oviger; *d*, palpus; *e*, third leg; *f*, tarsus and propodus.

Palpus slender, recurved, somewhat longer than proboscis, the terminal segments conspicuously spinose on the ventral surfaces.

Abdomen about seven-eighths as long as trunk, reaching at least to the end of the first coxal segments of the last pair of legs.

Third leg slender, with femur with a few spines distally, the first and second tibiae with two dorsal rows of long spines whose length is at least three times the width of the joint, and with shorter spines ventrally. Propodus without a heel but with two large basal spines

and several widely spaced spines along the sole. Terminal claw strongly curved, about half as long as propodus. Auxiliaries about a third as long as the terminal claw.

Oviger 10-jointed, with a few scattered denticulate spines on the terminal segments.

Measurements.—As follows:

	Mm.
Proboscis	1.5
Trunk	1.75
Second lateral process, width	1.75
Abdomen	.9

Third leg:	Mm.
Coxae	1.4
Femur	1.75
First tibia	1.9
Second tibia	1.9
Tarsus	.1
Propodus	.75
Terminal claw	.3

Remarks.—Heretofore species of *Ammothella* have been known only from littoral waters, and this deep record establishes a new bathymetric range for the genus. Only one other species, *A. bi-unguiculata*, is known from Japanese waters, and it can be separated easily from this species by the absence of the terminal claw. The locality is off southern Honshu.

Genus ASCORHYNCHUS Sars, 1877

Of the six species of this genus known to occur in Japanese waters, five are represented in the collections examined, and the key below is based primarily on the characters of these specimens.

1. Chelifore 2-jointed; extent less than two inches 2
   Chelifore 3-jointed; extent two to three inches ..... japonicus (p. 292)
2. Trunk, or lateral processes and coxae, with prominent dorsolateral tubercles or projections 3
   Without prominent tubercles or coxal processes ..... glaberrimus (p. 293)
3. Tarsus more than half as long as propodus 4
   Tarsus less than half as long as propodus ..... cryptopygius (Ortmann)
4. Abdomen more than half as long as proboscis 5
   Abdomen half as long or less than half as long as proboscis. auchenicus (p. 291)
5. Fingerlike processes on second coxae almost as long as width of joint. ramipes (p. 292)
   Processes on second coxae very short ..... glabroides (p. 293)

ASCORHYNCHUS AUCHENICUS (Slater)

Parazetes auchenicus Slater, 1879, pp. 281–283.
Ascorhynchus minutus Hoek, 1881, pp. 55–57, pl. 6, figs. 10–16.
Ascorhynchus bicornis Ortmann, 1891, pp. 162–163.
Ascorhynchus minutus Loman, 1908, p. 33.
Ascorhynchus ramipes (part) Loman, 1911, p. 6.
Ascorhynchus auchenicus Calman, 1922, pp. 199–203, figs. 1–4.

Collecting record.—*Albatross* station 3707 (1 ovigerous male); 3708 (1 female).

According to Calman's revision, based on Slater's type specimen of *Parazetes auchenicus*, and Hoek's *Challenger* types of *A. minutus*, these specimens represent the same species. Accordingly, its range is from Japanese waters to Port Philip, on the southern coast of Australia. Loman's specimen was taken by the *Siboga* Expedition at station 310 [latitude 8°30′ S., longitude 119° 7.5′ E., 73 m.]

ASCORHYNCHUS RAMIPES (Böhm)

Gnamptorhynchus ramipes Böhm, 1879b, pp. 56–59, fig. 1.
Ascorhynchus ramipes Ortmann, 1891, pp. 161–162, pl. 24, fig. 4.—Loman (part), 1911, p. 6.
Ascorhynchus ramipes var. *tsingtaoensis* Lou, 1936, pp. 2–19, figs. 2–6, pl. 1.

Collecting records.—Nagasaki, Japan (1 male). Tokyo Bay, E. S. Morse, collector (several specimens, including ovigerous males).

Lou's variety *tsingtaoensis* of this species is based on the following differences between his specimens from the China coast and the earlier descriptions of Böhm and Ortmann: The proboscis of *A. ramipes* is half as long as the trunk, whereas in Lou's specimens it is less than half as long, and likewise the abdomen is shorter than the proboscis in the variety instead of equal to it. The variety has a pair of small protuberances behind the base of the chelifores which were not described for the species.

With the exception of a somewhat longer abdomen than Lou's figures, these Japanese specimens agree so closely with his description that I do not believe a separate variety name is tenable. The small tubercles at the base of the chelifores are present, and the proboscis is less than half as long as the trunk.

ASORHYNCHUS JAPONICUS Ives

Ascorhynchus japonicus Ives, 1892, pp. 219–221.—Loman, 1911, p. 5.—Ohshima and Kishida, 1947, p. 1008, fig. 2859.

Collecting records.—*Albatross* stations 4980 (1 male); 5032 (2 males, 3 females); 5079 (2 males, 1 female); 5082 (3 males, 1 ovigerous; 1 female); 5084 (3 females); 5094 (2 females).

This handsome species is the most easily identified of the Japanese species of *Ascorhynchus*. It bears a superficial resemblance to the large *Ascorhynchus* of the Atlantic, *A. armatus* (Wilson), but it is much coarser in structure than the Atlantic species; the dorsal trunk tubercles are heavier and the proboscis is much stockier and blunter than in *A. armatus*. The collection of an ovigerous male is of interest, inasmuch as ovigerous males of the Atlantic species are unknown. The eggs are small, packed in a dense saclike mass which, in the preserved state, is draped over the oviger.

Apparently this species has an extensive bathymetric range; all previous collections appear to have been made in shallow water, whereas these records indicate a further range from 88 to 918 fathoms. The range of the *Albatross* stations at which this species was collected is from latitude 34° to 44° N., from southeast of Honshu to northeast of Hokkaido.

ASCORHYNCHUS GLABROIDES Ortmann

Ascorhynchus glabroides Ortman, 1891, pp. 160–161, pl. 24, fig. 3, *a*, *b*.—Loman, 1911, p. 7.

Collecting record.—*Albatross* station 4900 (1 male). This locality is west of Kyushu.

This specimen appears to be identifiable with this species; it is separable from the other members of the genus in the collection on the basis of the prominent tubercles on the lateral processes, which are two or three times as tall as those on the median line of the trunk, and the short processes or tubercles on the first coxae. These processes are pointed, about half as long as the width of the coxal joint, and are directed upward at a 45° angle. There is also a single small process on the middle of the second coxa. The proboscis is quite pointed, about half as long as the trunk. The abdomen reaches to about the middle of the second coxae of the last pair of legs.

ASCORHYNCHUS GLABERRIMUS Schimkewitsch

Ascorhynchus glaberrimus Schimkewitsch, 1913, pp. 242–244, pl. 3a, figs. 8–14; 1930, pp. 107–110, figs. 23–25.

Collecting record.—Nagasaki, Japan (1 ovigerous male, 1 female, 1 juvenile).

Compared with the other species from Japanese waters, *A. glaberrimus* has a bald, unadorned appearance. There are, however, low conical tubercles on the ends of the lateral processes, and small tubercles at the bases of the chelifores. So far, this species is known only from the vicinity of Nagasaki, and no record of its bathymetric distribution is available.

Genus CILUNCULUS Loman, 1908

The principal characters that set this genus off from such closely related genera as *Ammothella* and *Heterofragilia* are the longer second joint of the oviger, the tubular femoral cement gland of the male (which is present in some species of *Ammothella*), and the overhanging dorsal process of the cephalic segment. A very closely related form from Brazil is that described by Mello-Leitão (1946) as *Acanthammothella*, which I have already suggested (1948, p. 262) is a

Cilunculus. However, *Acanthammothella* has a short second joint of the oviger and lacks auxiliary claws on the legs, which are present in all the known species of *Cilunculus*. The latter character is not a good generic character, since it does not hold in such genera as *Nymphon* and *Pycnogonum* and in *Ammothella* there is one species, *uniunguiculata* (Dohrn) which lacks auxiliaries, and another, *biunguiculata* (Dohrn) which has auxiliaries but lacks the main terminal claw. The cement glands of *Acanthammothella* are mentioned as "abundant," which indicates that this form does not have the femoral tube of the typical *Cilunculus*. Inasmuch as a great variety of forms of the cement gland, from a row of open pores to an elaborate vesicular process, occurs in *Anoplodactylus* (Hedgpeth, 1948, p. 219), and a tubular gland is present in most species of *Ammothella* but lacking in *A. bi-unguiculata*, the presence or absence of this structure is at best an incomplete character. Except for the short second joint of the oviger, therefore, Mello-Leitão's *Acanthammothella* cannot be separated from *Cilunculus* and its general form indicates its close relationship to that genus. In the structure of the oviger it resembles *Heterofragilia*, a genus from the Lesser Antilles. It is apparent that those various small ammotheid genera are in need of more thorough study.

CILUNCULUS ARMATUS (Böhm)

FIGURE 43

Lecythorhynchus armatus BÖHM, 1879c, pp. 141–142.
Parazetes pubescens ORTMANN, 1891, pp. 163–164, pl. 24, figs. 5, *a–d*.
Cilunculus armatus LOMAN, 1911, pp. 9–11, pl. 1, figs. 1–8.

Collecting records.—Albatross stations 3734 (1 female); 5021 (1 ovigerous male, 1 female); 5037 (1 female).

Loman's figures do not do justice to this quaint little creature and since his paper is not easily accessible I have figured a specimen from *Albatross* station 3734. The processes and tubercles on the trunk and lateral processes are more prominent than would appear from his drawings. The proboscis is prominently egg-shaped, which is the best field mark for separating it from the species of *Ascorhynchus*. The overhanging forward edge of the trunk or cephalic segment seems to be a character of the genus, as is the possession of a prominent femoral gland duct in the male, located in this species about midway on the dorsal surface of that joint. This is evidently a cold-water form, occurring from Sagami Bay to the Sea of Okhotsk.

Genus LECYTHORHYNCHUS Böhm, 1879

Loman (1908, p. 54) appears to have been the first to suggest that this genus belongs in the Ammotheidae.

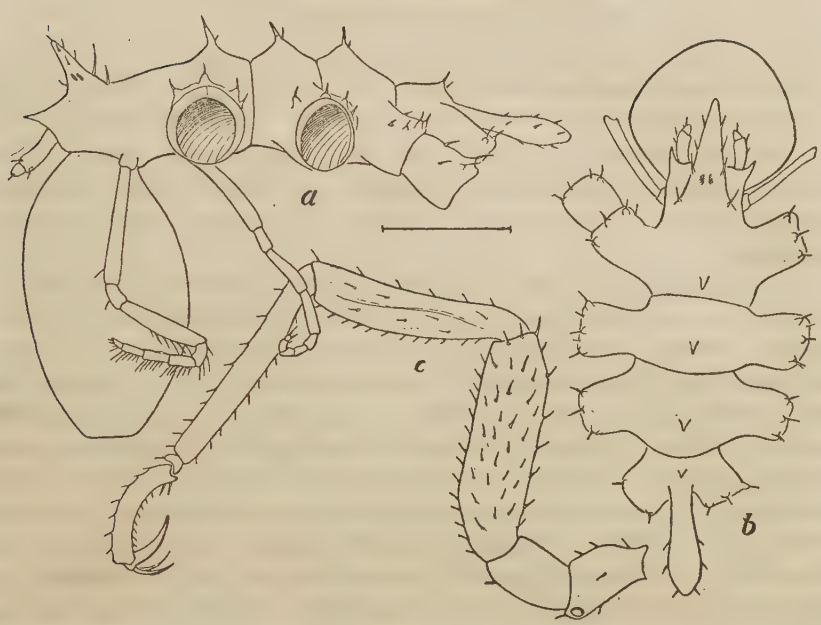

FIGURE 43.—*Cilunculus armatus* (Böhm): *a*, Lateral view; *b*, dorsal view; *c*, leg. All drawings of female specimen, to same scale. (Line equals 1 mm.)

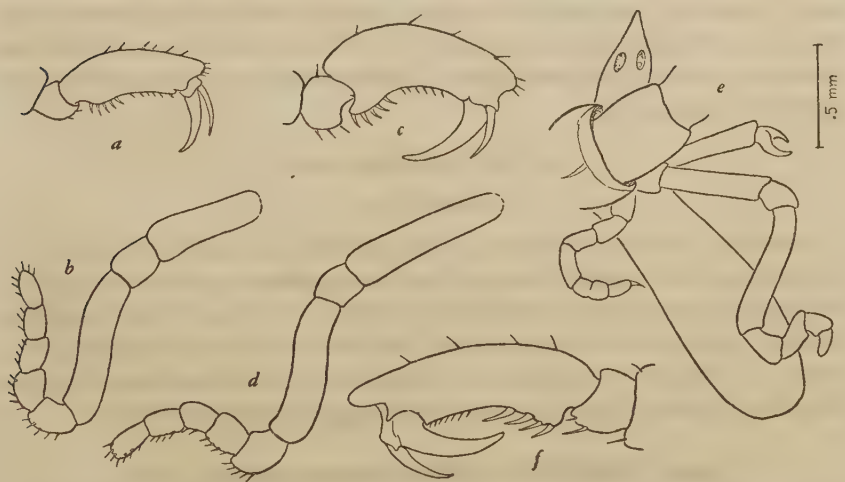

FIGURE 44.—*a*, *b*, *Lecythorhynchus hilgendorfi* (Böhm): *a*, Tarsus and propodus; *b*, palpus. *c*, *d*, *L. marginatus* Cole: *c*, Tarsus and propodus; *d*, palpus. *e*, *f*, *Lecythorhynchus* sp.: *e*, Lateral view of anterior region; *f*, tarsus and propodus.

LECYTHORHYNCHUS HILGENDORFI (Böhm)

FIGURE 44, *a*, *b*

Corniger hilgendorfi BÖHM, 1879a, pp. 187–189, pl. 2, figs. 3–3d.
Lecythorhynchus hilgendorfi BÖHM, 1879c, pp. 140–141.—LOMAN, 1911, pp. 8–9, pl. 2, figs. 28–29.—OHSHIMA and KISHIDA, 1947, p. 1009, fig. 2864.

Collecting records.—Sarawato Chochi, July 20–23, 1929, A. S. Pearse, collector; 3 specimens. Takami, near Chochi, July 23, 1929, A. S. Pearse, collector; several specimens. Peiyushan Island; several specimens.

Three species have been proposed for this genus: *L. hilgendorfi* from Japan, *L. marginatus* Cole (1904) from California, and *L. ovatus* Hilton (1942d) from Hawaii. While it is impossible to pass final judgment on Hilton's species, it appears to be very closely related to the California form (which is found on the Pacific coast as far south as Cerro Island, Baja California) and the principal character, the serrate palpus, is possibly an illusory one, as I have noticed that specimens of *L. marginatus* when inspected *in vitreo* seem to have this character, but when mounted on a slide, appear as in figure 44, d. Certainly *L. hilgendorfi* and *L. marginatus* are closely related, but they can be distinguished on the basis of the structure of the palpus. In *L. marginatus* the sixth joint is inserted at a distinct angle from the fifth joint, whereas in *L. hilgendorfi* this is not so pronounced (fig. 44, a and c) although Ohshima's (1927d, pl. 7, fig. 5) figure indicates that this condition is present in some specimens. The auxiliary claws are much longer in the Japanese species, and the heel of the propodus is not as prominent as in *L. marginatus*. This is probably a littoral or subtidal species of central Japan. These records are from the eastern coast of Honshu.

? LECYTHORHYNCHUS species

FIGURE 44, *e-f*

Collecting record.—*Albatross* station 3730 (1 immature female).

Although considerably larger than the specimens of *L. hilgendorfi*, this appears to be an immature specimen, to judge from the undeveloped appearance of the oviger and the chelate chelifores. The conformation of the palpus and propodus of this specimen suggest *Lecythorhynchus*, but its generic affiliation is none too certain.

Family TANYSTYLIDAE Schimkewitsch, 1913

Genus TANYSTYLUM Miers, 1879

Among the notes that Prof. Hiroshi Ohshima kindly turned over to me are drawings and measurements of an undescribed species of *Tanystylum*. Inasmuch as no species of this genus has been described

from Japanese waters, the following description, based on these notes, and adopting Ohshima's manuscript name, is submitted. I wish to thank Professor Ohshima for the free use of these notes in order to make a valuable addition to our knowledge of the distribution of this genus.

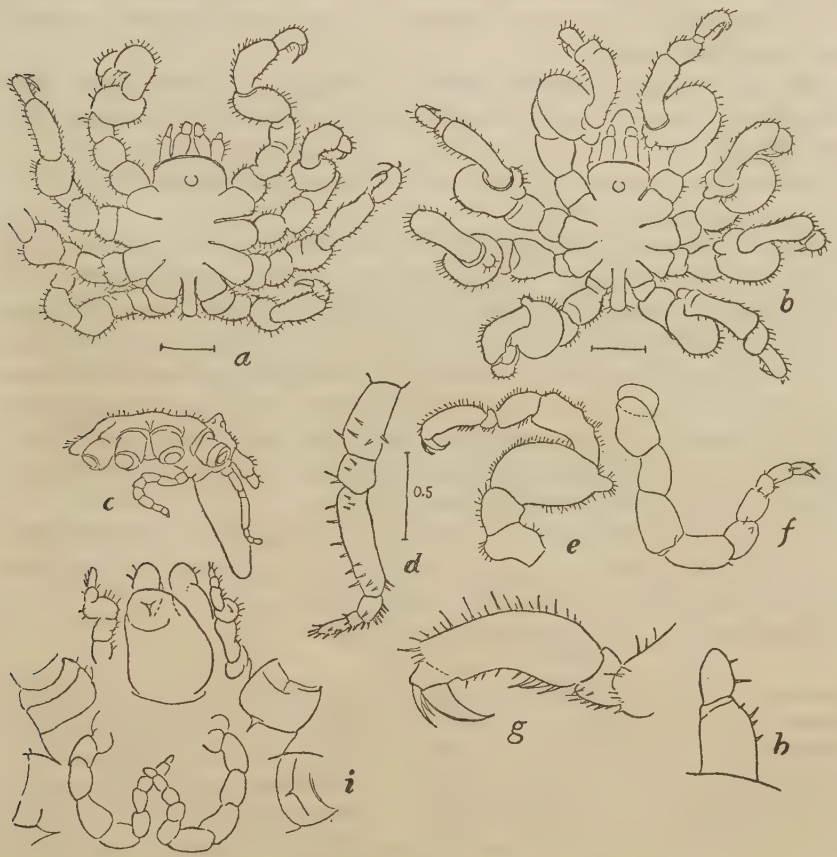

FIGURE 45.—*Tanystylum anthomasthi*, new species: *a*, Dorsal view of specimen 1; *b*, dorsal view of specimen 2; *c*, lateral view; *d*, palpus; *e*, second leg; *f*, oviger; *g*, tarsus and propodus; *h*, chelifore, ventral view of anterior half of body. (Lines under *a* and *b* equal 1 mm.)

TANYSTYLUM ANTHOMASTHI, new species

FIGURE 45

Collecting records.—Daikoku Jima, mouth of Akkeshi Bay, Hokkaido, July 10, 1940, attached to *Anthomasthus*, Dr. Okuda-Shirō, collector, 2 specimens (both apparently females).

Description.—Trunk circular in outline, the lateral processes contiguous but not coalesced. The cephalic segment is slightly prolonged

anteriorly. There are no dorsal tubercles or processes. Both trunk and legs are covered with fine hairlike setae. Eye tubercle about as broad at base as high, roundly conical.

Proboscis slightly shorter than trunk, tapering to a blunt rounded tip, directed downward.

Chelifore short, basal segment as wide as long. Second segment about half as long as basal, rounded. A few spines on the outer surface of both joints.

Palpus 7-jointed, slender, almost as long as proboscis; the joints armed with short spines. The fourth joint is slightly longer than the second.

Abdomen about twice as long as last lateral process, horizontal or directed slightly ventrad.

Leg: Coxae subequal, or second slightly longer than the other two. Femur about as long as coxae together, swollen, with a prominent rounded knob on the dorsodistal end. First tibia two-thirds as long as femur, with low knobs on the dorsal surface bearing short spines or setae. Second tibia half as long as first, also with low knobs and setae. Tarsus very short, triangular in lateral view. Propodus rather stout, slightly curved, without heel but bearing three prominent basal spines. Terminal claw heavy, curved, half as long as propodus. Auxiliaries little more than half as long as terminal claw.

Oviger: First joint shorter than broad, second and third subequal, fourth slightly longer. Joints 7–10 diminishing in size, armed with pairs of short spines on the ventrodistal margins.

Measurements (of "specimen 2"), as follows:

	Mm.
Proboscis	1.9
Trunk	2.0
Chelifore	.35
Oviger	2.5
Abdomen	.8
Palpus	1.38

Third leg:	*Mm.*
Second coxa	0.7
Third coxa	.7
Femur	1.7
First tibia	1.3
Second tibia	1.0
Tarsus	.25
Propodus	.8
Terminal claw	.4
Auxiliary claw	.25

Remarks.—This species resembles *T. orbiculare* Wilson in lacking tubercles on the trunk and coxae, but it is evidently distinct from other species in the genus because of its coating of fine hairlike setae.

Family COLOSSENDEIDAE Hoek, 1881

Genus COLOSSENDEIS Jarzynsky, 1870

COLOSSENDEIS ANGUSTA Sars

Colossendeis angusta Sars, 1877, pp. 268–269.—Loman, 1908, p. 22.—Hilton, 1943b, p. 3.

Collecting records.—Albatross stations 4969 (2 specimens); 4975 (1 specimen); 4980 (1 specimen); 5043 (3 specimens); 5050 (4 specimens); 5083 (3 specimens).

This well-known species is widely distributed throughout the colder waters of the world, north and south. There is no significant difference between these Japanese specimens and those taken from New England waters on the early cruises of the *Albatross*, with which they have been compared. These are the first records of this species in Japanese waters, although Hilton identifies several specimens from the eastern North Pacific. The stations at which this species was collected range from latitude 33°23′ N. to 42°10′ N., all off the eastern shores of the archipelago.

COLOSSENDEIS COLOSSEA Wilson

Colossendeis colossea Wilson, 1881, pp. 244–246, pl. 1, fig. 1; pl. 3, figs. 5–7.—Ohshima, 1936, pp. 866–867.—Ohshima and Kishida, 1947, p. 1009, fig. 2863.
Colossendeis gigas Ohshima and Kishida, 1947, p. 1009, fig. 2862.

Collecting records.—Albatross stations 4974 (1 specimen); 5082 (1 specimen).

Comparison of these specimens with several taken from the Western Atlantic (the type region) shows no significant differences and confirms the suspicion of previous workers that this is an ubiquitous deep-water species. Both these records are southeast of Honshu.

COLOSSENDEIS MACERRIMA Wilson

Colossendeis macerrima Wilson, 1881, pp. 246–247, pl. 1, fig. 2; pl. 4, figs. 9–12; pl. 5, fig. 32.—Calman, 1923, pp. 267–268.—Ohshima, 1936, p. 867.

Collecting locality.—Albatross station 5083 (1 male?).

One small recently moulted specimen of this species is represented in the collection. The proboscis measures 1.75 mm., and the specimen is about half the size of an average full-grown example from the North Atlantic. It appears to be a male. Like *C. colossea*, this is evidently a cosmopolitan deep-water species. This locality is southeast of Honshu.

COLOSSENDEIS JAPONICA Hoek

Figure 46, *a-d*

Colossendeis japonica Hoek, 1898, pp. 295–296, pl. 2, fig. 3.

Collecting record.—Albatross stations 4912 (3 specimens); 4915 (1 specimen).

This is the second record for this species, which was first collected by the *Challenger* at station 237, latitude 34°37′ N, longitude 140°32′ E, 1,875 fathoms. In appearance it is superficially like *C. angusta*, but it is readily separable from that species by the short second joint of the palpus and by the combination of long tarsus and short terminal claw. The proboscis in these specimens is somewhat longer than the

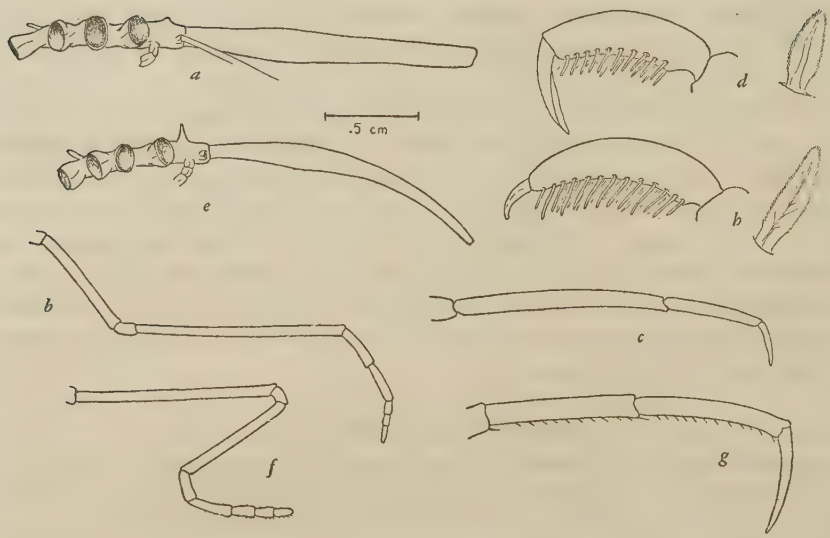

FIGURE 46.—*a-d*, *Colossendeis japonica* Hoek: *a*, Lateral view; *b*, palpus; *c*, tarsus and propodus; *d*, terminal joint and spine of oviger. *e-h*, *C. nasuta*, new species: *e*, Lateral view of holotype; *f*, palpus; *g*, tarsus and propodus; *h*, terminal joint and spine of oviger.

specimen figured by Hoek and the tarsus is more than twice as long as the propodus instead of about one-and-one-half times as long; in one specimen (fig. 47, a) the proboscis is 16 mm. long and the trunk is 9 mm. long. Both these stations are southwest of Kyushu.

COLOSSENDEIS DOFLEINI Loman

FIGURE 47, *a–d*

Colossendeis dofleini LOMAN, 1911, pp. 4–5, pl. 1, figs. 6–13.—OHSHIMA, 1936, p. 867.

Collecting records.—*Albatross* stations 3331 (1 specimen); 4803 (1 specimen); 4804 (1 female, 1 juvenile); 5029 (1 specimen); 5079 (1 female).

This appears to be a somewhat variable species; the proboscis of the specimen from *Albatross* station 5029 is not so conspicuously dilated as those of the other specimens, but it is otherwise inseparable from them. The terminal joints of the palpus are somewhat shorter than figured by Loman.

C. dofleini is evidently a widely distributed species in the North Pacific. Station 5079 is south of Honshu; all the others are east of the Kuriles.

COLOSSENDEIS CHITINOSA Hilton

FIGURE 47, *e–h*

Colossendeis chitinosa HILTON, 1943b, p. 4.

Collecting records.—*Albatross* stations 3703 (1 specimen); 4982 (6 specimens).

Sagami Bay, 1 specimen.

Identification of this species has been confirmed by examination of the type material, from which it differs in the possession of a somewhat longer terminal claw. As the species has not been described or figured, a description, based on the above specimens, follows:

Trunk completely segmented, with ringlike swellings at the distal ends of the segments. This ring is projected into a sharply pointed tubercle dorsally. The eye tubercle is about twice as tall as the dorsal trunk tubercles, sharply pointed with the point projected forward. The eyes are heavily pigmented, located in the basal third of the tubercle. Although Hilton describes the eyes as "being at different levels" they are not conspicuously so; it is the forward slant of the eye tubercle which gives this impression.

Abdomen very small, bluntly conical and almost ventral in location.

Proboscis longer than trunk, dilated, curved downward as in *C. dofleini*.

Palpus second joint curved, about one and one-third as long as fourth. Joints 7 to 9 long, slender, subequal, sixth slightly shorter than seventh.

Third leg coxae subequal, about as broad as long. Femur and second tibia subequal, first tibia about a third longer than femur. Tarsus slightly longer than propodus, terminal claw almost as long as propodus. The sole of both tarsal joints bears a closely set row of fine, short spines.

Oviger somewhat short for a member of this genus. Second and fourth joints subequal. Terminal joints subequal, with several rows of spines which do not appear to be denticulated. On the last segment there is a large spine opposing the terminal claw, forming a subchelate structure.

Measurements.—Proboscis, 6 mm.; trunk 3.5 mm.; third leg, ca. 25 mm.

Remarks.—This species is superficially close to *C. dofleini*, but is about two-thirds as large, with much slenderer legs and terminal claw. *Colossendeis dofleini* has no spines on the tarsal joints. In the structure of the terminal segment of the oviger it resembles *C. californica* Hedgpeth (1939), but differs from that species in the structure of the eye tubercle and shorter terminal claw.

C. chitinosa ranges from Sagami Bay to the Aleutians.

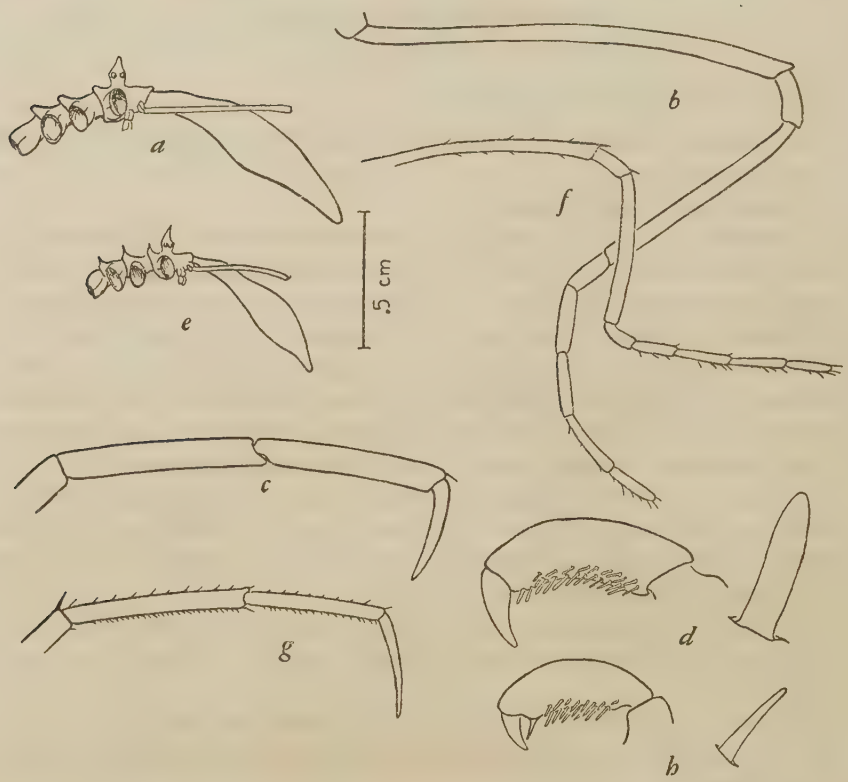

FIGURE 47.—*a-d*, *Colossendeis dofleini* Loman: *a*, Lateral view; *b*, palpus; *c*, tarsus and propodus; *d*, terminal joint and spine of oviger. *e-h*, *C. chitinosa* Hilton: *e*, Lateral view; *f*, palpus; *g*, tarsus and propodus; *h*, terminal joint and spine of oviger.

COLOSSENDEIS NASUTA, new species

FIGURE 46, *e–h*

Holotype.—U.S.N.M. No. 80548.

Collecting record.—*Albatross* station 4912, latitude 31°39′40″ N., longitude 129°40′ E., 391 fathoms, August 12, 1906.

Description.—Trunk elongated, unsegmented, lateral processes separated by about their own diameter. Eye tubercle conical, sharply pointed, eyes not apparent. The trunk and legs are without any tubercles or prominent spines.

Abdomen papilliform, about as long as first coxae of last legs.

Proboscis about one and one-half times as long as trunk, slender, curved gracefully downward. Its greatest diameter occurs in the proximal third, and it tapers gradually to about half that diameter at the tip.

Palpus somewhat longer than proboscis, the terminal segments diminishing in size. The second segment is about twice as long as the fourth, and the third half as long as the fifth.

Third leg: Coxae subequal, about as broad as long. Femur and first tibia subequal, second tibia somewhat shorter. Tarsus and propodus equal, terminal claw two-thirds as long as propodus. The sole of both tarsal joints bears a row of small, well-separated spines.

Oviger: Second and fourth segments subequal, third about a third as long. Terminal segments subequal, tightly coiled, bearing several rows of rather long compound spines. The compound spines are very finely denticulate. The last joint is slender and tapering, with a terminal claw that is about as long as the width of the segment itself.

Measurements.—As follows:

	Mm.
Proboscis	14.0
Trunk	8.0
Second lateral process, width	3.25
Abdomen	1.75
Palpus	ca. 19.5

Third leg:	Mm.
Coxae	3.5
Femur	19.0
First tibia	20.0
Second tibia	13.5
Tarsus	3.0
Propodus	3.0
Terminal claw	2.0

Remarks.—The combination of a long, slender, curved proboscis and a very long terminal claw separates this species from other members of the genus. The specimen appears to be a male. It was collected at the same station as *C. japonica*, southwest of Honshu.

Family PYCNOGONIDAE Wilson, 1878

Genus PYCNOGONUM Brünnich, 1764

PYCNOGONUM TENUE Slater

FIGURES 48, *b*; 50, *c*

Pycnogonum littorale var. *tenue* SLATER, 1879, pp. 281–283.

Pycnogonum tenue OHSHIMA, 1936, p. 867.—OHSHIMA and KISHIDA, 1947, p. 1010, fig. 2865.

Collecting records.—Albatross stations 3707 (1 female); 3708 (2 females); 3716 (1 female); 4893 (1 male); 4895 (1 male); 4933 (1 female).

This species has not been previously figured except in generally inaccessible Japanese works and the original description leaves several important details undiscussed. Although it does superficially resemble *P. littorale* in the shape of its proboscis, the dorsal trunk tubercles are quite high, sometimes prolonged to points, and the integument is lightly reticulated as well as granulated. In some specimens the reticulations are not apparent; in others they occur together with granulations. The oviger is 9-jointed, exclusive of the terminal claw. The genital pores are on the second coxae. In the female they are dorsal whereas in the male they are ventral, on a low but well-developed conical tubercle. I could find them only on the last pair of legs.

All these records are west of Kyushu.

PYCNOGONUM UNGELLATUM Loman

FIGURE 48, *c*; 50, *e–g*

Pycnogonum ungellatum LOMAN, 1911, pp. 7–8, pl. 2, figs. 25–27.—OHSHIMA, 1937, p. 868.

Collecting records.—Albatross stations 4803 (1 female); 4804 (1 male, 1 female).

Loman's description of this species, based on an immature specimen, is inadequate. The oviger is 9-jointed instead of 8-jointed and the legs are much shorter and thicker than indicated in his figure. The proboscis is somewhat variable. In the specimen I have chosen for illustration it is barrel shaped, as in Loman's figure. The abdomen is squarish at the tip. *P. ungellatum* is apparently related to *P. stearnsi* Ives, but it is without the dorsal trunk tubercles of that species. The genital pores are on the ventral surface of the last two pairs of coxae.

Measurements (of apparently mature specimens).—As follows:

Male, station 4803	*Mm.*	*Female, station 4804*	*Mm.*
Proboscis	2.5	Proboscis	3.0
Trunk	6.0	Trunk	7.0
Width, second lateral process	3.75	Width, second lateral process	4.0
Abdomen	1.5	Abdomen	1.5

These two stations are in the Sea of Okhotsk, east of southern Sakhalin.

PYCNOGONUM BENOKIANUM Ohshima

FIGURE 49

Pycnogonum benokianum OHSHIMA, 1935a, pp. 137–139.—OHSHIMA and KISHIDA, 1947, p. 1010, fig. 2866.

Although this species is described from specimens collected from Okinawa and is not represented in any collections available to me, it seems appropriate to publish a translation of the Japanese description, which is unaccompanied by any figures or synopsis in a European language. While a figure has been published in the "Illustrated Encyclopedia of the Fauna of Japan," this work is not generally available, and I am able to provide figures from Professor Ohshima's notes. The description that follows is based on a literal translation prepared by Dr. Masui Kodani, together with notes supplied by Professor Ohshima, and I wish to thank Dr. Kodani for his generous assistance in this and several other details connected with the Japanese language. I am especially indebted to Professor Ohshima for supplying the additional notes and drawings. Items in brackets are my own comments and additions.

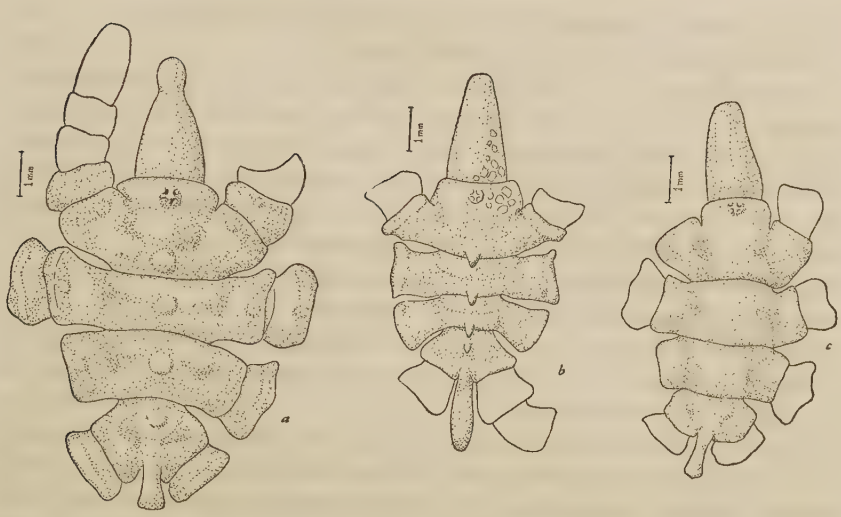

FIGURE 48.—*a, Pycnogonum buticulosum,* new species; *b, P. tenue* Slater; *c, P. ungellatum* Loman.

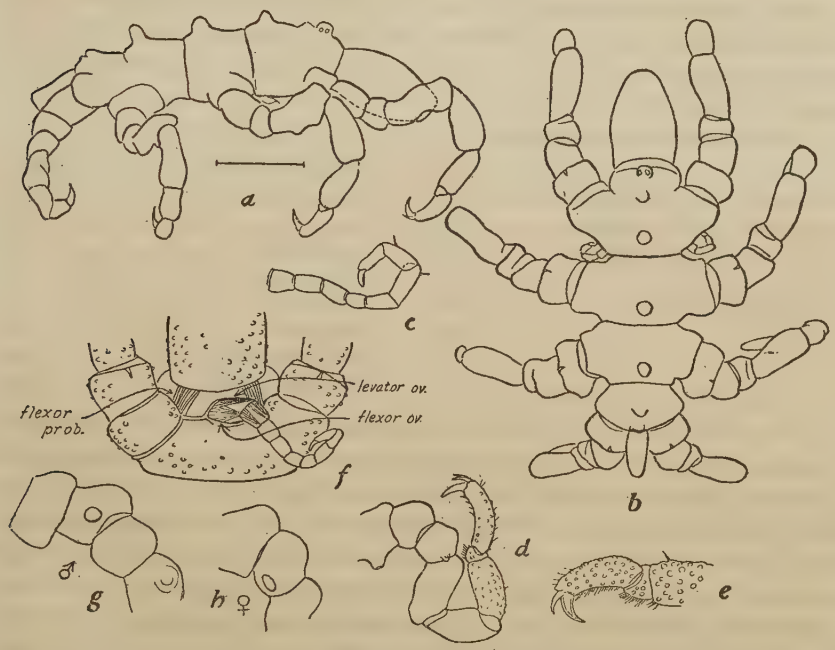

FIGURE 49.—*Pycnogonum benokianum* Ohshima: *a,* Lateral view; *b,* dorsal view; *c,* oviger; *d,* leg; *e,* tarsus and propodus; *f,* view of abnormal specimen, showing location and musculature of single oviger; *g,* male genital pore; *h,* female genital pore.

Type locality.—Benoki, Okinawa islands. Collected by Shimoto Toma, between January and March 1932.

Description.—Trunk fat, knobby. Integument granular, the granulations coarse, on elevated portions of the trunk. Lateral processes large, nearly as long as the length of the trunk segment, well separated. First trunk segment somewhat rhombic, two-thirds as long as wide. Eye tubercle near anterior margin, low. On the posterior edge of each trunk segment there is a rounded dorsal tubercle.

Proboscis large, slightly more than one-third as long as trunk, basal half cylindrical, distal half bluntly conical.

Abdomen cylindrical, shorter than length of fourth trunk segment.

Oviger 8-jointed, with a terminal claw. Last two segments bearing spines near their outer edge.

Third leg: First coxa almost as large as lateral process, with a notch on the distal posterior part. Second and third coxae diminishing in size. Femur longer than either tibia, with swellings on the inner basal and dorsodistal regions. There are short spines toward the distal end of the femur and first tibia. On the distal ventral margin of the second tibia, and the sole of the tarsus and propodus, is a row of short spines. Terminal claw slightly curved, about half as long as propodus, with small, deciduous auxiliaries. Genital pore on ventral surface of second coxae of last two pairs of legs in both sexes. Eggs about 0.07 mm. in diameter.

Measurements.—As follows:

	Mm.
Proboscis	1.25
Length first trunk segment	.87
Length last trunk segment	.7
Abdomen	.6
Total length trunk	2.82

Second leg:	*Mm.*
Coxae	1.2
Femur	.75
First tibia	.7
Second tibia	.6
Tarsus	.12
Propodus	.5
Terminal claw	.2
Total length leg	3.97

Remarks.—This new species resembles very closely *P. pusillum* Dohrn, which occurs in the Bay of Naples and is characterized by the granular integument and the presence of auxiliary claws. The one distinct difference is that the genital opening occurs on the dorsal side in *P. pusillum*, whereas in this species it is on the ventral side. No observations have been made of the male of Dohrn's species. Bouvier's statement that there are no tubercles on the median dorsal line of the trunk in *P. pusillum* seems to be an error made by him in reading Dohrn's original description. *P. ungellatum* Loman, which occurs along the coast of Sagami [immediately south of Tokyo Bay], closely resembles *P. benokianum*. [At this point Ohshima's description dis-

cusses the difference in proportions of the joints of the oviger of *P. ungellatum*, based on Loman's figures, which are inaccurate, since the basal joint was overlooked by Loman.]. *P. tenue* (Slater), *P. stearnsi* Cole [sic], both occurring in Japanese waters, *P. crassirostre* Sars from the North Atlantic, and *P. magellanicum* Hoek are all similar to the new species in body shape but lack auxiliary claws, and in this respect differ distinctly from it.

According to Mr. Toma [the collector] this species is attached to a sea anemone which occupies concavities of rock on shallow bottom. Occasionally three sea spiders are found attached to a single host. In the preserved specimen sent to me by the collector I found one hooked to the outer body wall of the host, while four more were enclosed in the gastrovascular cavity. In the literature there is only one species which is known to live attached to sea anemones, *P. littorale* (Ström), occurring commonly in northern Europe. [*P. stearnsi* Ives is reported in association with the large green California coastal anemone *Cribrina xanthogrammica* by Johnson and Snook, 1927, p. 409, Hilton, 1934, Ricketts and Calvin, 1939, p. 54, Hedgpeth, 1941, p. 254, and *P. rickettsi* Schmitt is reported in association with *Metridium* by Schmitt, 1934, *fide* Ricketts.] The earliest record is that of Milne Edwards, who found it on *Cynthia* and fish (divers poissons). E. B. Wilson wrote that it is perhaps parasitic on *Bolocera tuediae*, a sea anemone, because it is often found attached to the lower side. Also G. O. Sars (1891) wrote that it is firmly hooked to *Tealia digitata* and *T. crassicornis* but that it could not be decided whether or not it fed on them. Recent information is scarce but Prell (1911) stated that it [*P. littorale*] is often attached to *Urticina* (*Tealia*) *crassicornis*, and Meisenheimer (1925) found it on *Actiniloba* (*Metridium*) *dianthus* and stated that it absorbs the body fluid through the proboscis, which is buried in the body of the host. According to Arndt (1913) it lives on *Milne-Edwardsia loweni* and according to Cuénot (1921) it also lives on *Cynthia*. Prell observed it very closely and wrote that it is attached not only on four different kinds of sea anemone in an aquarium but also on *Lucernaria* (a jellyfish) and *Cucumaria frondosa*. Dogiel (1913) supplemented this observation while studying its development and stated that only the adult is found attached to the sea anemone and that the younger stages are found only [?] in *Clava multicornis*.

I have named our new species after the place where it was collected. Its mode of living is not yet fully known. It is rather rare that two very similar species of sea spider live so very far apart and at very different latitudes.

PYCNOGONUM BUTICULOSUM, new species

FIGURE 48, *a;* FIGURE 50, *a, b*

Types.—Holotype (male): U.S.N.M. No. 80571, *Albatross* shore trip, June 23, 1906, Milne Bay, Simushiru.

Paratypes (4 males, 2 females): Same locality.

Description.—Trunk fat, compact, and broad. Lateral processes narrowly separated. The posterior dorsal margin of the first three

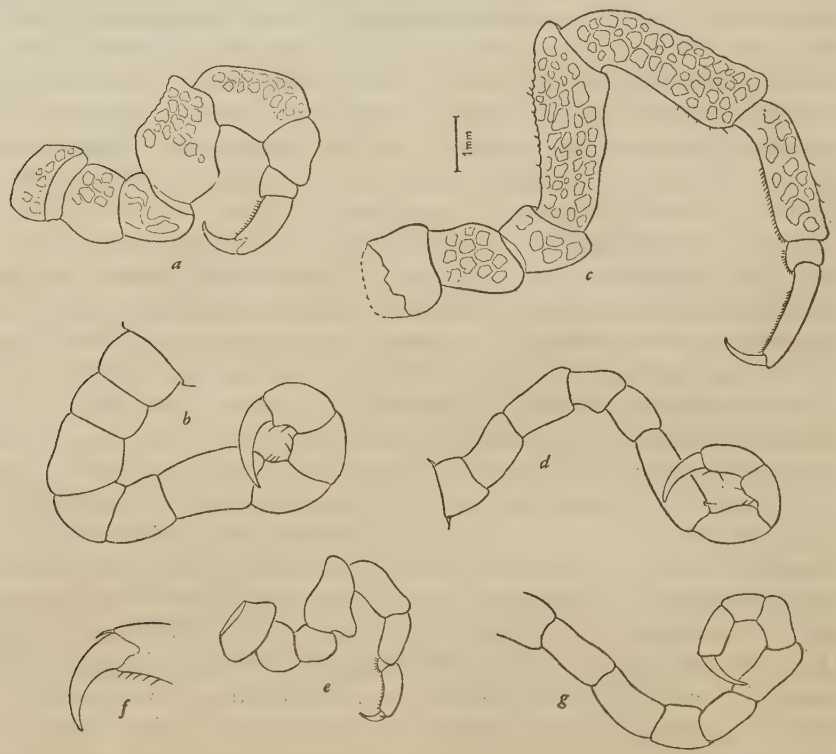

FIGURE 50.—*a, b, Pycnogonum buticulosum*, new species: *a*, Third leg; *b*, oviger. *c, d, P. ienue* Slater: *c*, Third leg; *d*, oviger. *e–g, P. ungellatum* Loman: *e*, Third leg; *f*, detail of terminal and auxiliary claws; *g*, oviger.

trunk segments is raised in a ridge, at the center of which is a prominent rounded tubercle, and there is also a ridge on the dorsodistal margin of the lateral processes. There is a smaller tubercle on the last trunk segment, without such a prominent ridge. The eye tubercle is rounded, about as high as the dorsal trunk tubercles, with prominent eyes. Integument granular, in some specimens also lightly reticulated.

Proboscis slightly more than half as long as trunk, nipple- or bottle-shaped.

Abdomen short, clavate or square tipped, reaching to the distal margin of the first coxae of the last legs.

Third leg short and knobby, with reticulations in some specimens. Terminal claw more than half as long as the propodus, without auxiliaries. Sole of propodus armed with a row of fine spines. Genital pore on dorsal surface of second coxae of last pair of legs of female, possibly the last two pairs; I could not find them on the male.

Oviger 9-joined, the segments short and thick. The claw is somewhat longer than the terminal segment.

Measurements.—As follows:

	Holotype, ♂ Mm.	*Paratype, ♀ Mm.*
Proboscis	4.0	6.0
Trunk	7.0	9.5
Second lateral process, width	5.0	6.5
Abdomen	1.5	2.0

Holotype Third leg:	*Mm.*
Coxae	2.0
Femur	2.0
First tibia	1.5
Second tibia	1.0
Tarsus	.5
Propodus	1.25
Terminal claw	.75

Remarks.—This species bears a superficial resemblance to *P. stearnsi* Ives, which is reported from the North Kuriles by Ohshima (1933d), but it is readily separated from that species by the peculiar shape of the proboscis. Simushiru is one of the islands of the Kurile group.

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APPENDIX

Detailed information relative to *Albatross* stations will be found in Appendix Table 1.

Localities at which pycnogonids have been collected in Siberian waters, taken from Losina-Losinsky (1933) are tabulated in Appendix Table 2. In the latter, English place names are taken from Hydrographic Office Publication No. 122 (1932), "Sailing Directions for Siberia and Chosen." Several localities falling within the area of the station chart have been omitted: Askold Island, Rimsky-Korsakoff Island, Furugelma Island, Naumova Island, and Srednyaya Bay. These are all in the vicinity of Peter the Great Bay. Two localities are north of 50°: Kastri Bay (latitude 51°30′ N., longitude 140°53′ E.) and Kazakevicha Bay (slightly north of 50°, near longitude 142° E.).

I have retained the specific and subspecific names of the Russian text to facilitate reference to it although some of the subspecific names must be changed as Marcus (1940, pp. 128–129) has suggested. Thus *Achelia echinata orientalis* should be *A. echinata nasuta; A. gracilipes borealis* should be *A. gracilipes tatarica;* and *A. borealis japonica* should be *A. borealis nipponica.*

There appear to be typographical errors in some of the dates or station numbers, and probably in some of the station positions.

ABBREVIATIONS USED IN THE TABLES

bk. black
br. brown
brk. broken
co. coral
crs. coarse
dk. dark
fn. fine
for. Foraminifera
g. gravel
glob. globigerina
gn. green
gy. gray
m. mud
oz. ooze
p. pebbles
r. rock
rd. red
rky. rocky
s. sand
sa. sabulous (sandy)
sh. shells
sp. specks
st. stones
vol. volcanic

FIGURE 51.—Stations which pycnogonids were collected by the Albatross, 1900 and 1906.

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APPENDIX TABLE 1

LIST OF STATIONS AT WHICH PYCNOGONIDS WERE COLLECTED BY THE ALBATROSS, 1900 AND 1906

Station No.	Date	Locality	Depth	Temp. °F.	Type of bottom	Species of pycnogonids
	1900	*Off Honshu*	*Fathoms*			
3697	May 5	Manazuru Zaki, N, 26°; W, 6.0 mi.	120–265	-------	gy. m., vol.s.	*Nymphon kodanii.*
3698	May 5	Manazuru Zaki, N, 8°; W, 4.5 mi.	150	-------	gn.m., s.	*Nymphon japonicum, kodanii.*
3701	May 7	Seno Umi, N, 10°, W, 2.3 mi.	41–73	-------	vol.s., g.	*Nymphon japonicum.*
3703	May 7	Seno Umi, N, 16°; E, ⅝ mi.	31	-------	vol.s., g.	*Colossendeis chitinosa, Anoplodactylus gestiens.*
3707	May 8	Ose Saki, S, 53°; W, 2.5 mi.	63–70	-------	vol.s., a., g.	*Ascorhynchus auchenicus, Pycnogonum tenue.*
3708	May 8	Ose Saki, S, 55°; W, 2.25 mi.	60–70	-------	gn. m.	*Nymphon japonicum, Ascorhynchus auchenicus, Pycnogonum tenue.*
3715	May 11	Ose Saki, S, 56°; W, 1.6 mi.	65–68	-------	vol. s., sh, r.	*Anoplodactylus gestiens.*
3716	May 11	Ose Saki, S, 36°; W, 0.8 mi.	65–125	-------	vol.s., sh, r.	*Pycnogonum tenue.*
3730	May 16	Omai Zaki Lt., N, 17°; E. 14.5 mi.	34–37	-------	m., g., r.	*Nymphon japonicum; Pallenopsis virgatus; Lecythorhynchus sp.*
3734	May 16	Omai Zaki Lt., N, 25°; E, 11 mi.	36–48	-------	crs. gy. vol. s, brk, sh.	*Nymphon japonicum, Ciluniculus armatus.*
3739	May 17	Ose Zaki, S, 25°; W, 0.25 mi.	55–65	-------	vol. s., sh., r.	*Anoplodactylus gestiens.*
3750	May 19	Suno Saki, S, 89°; E, 9.25 mi.	83–140	-------	gy. s., brk. sh., p.	*Nymphon japonicum.*
3752	May 19	Suno Saki, S, 71°; E, 3.25 mi.	54–100	-------	gy. s., g.	*Nymphon japonicum.*
3755	May 19	Suno Saki, S, 63°; E, 3.6 mi.	52–77	-------	gy. s., co.	*Nymphon japonicum.*
3757	May 19	Suno Saki, S, 64°; E, 2.5 mi.	41–50	-------	crs. co., s., g.	*Nymphon japonicum.*

Station No.	Date	Lat. N.	Long. E.	Depth	Temp. °F.	Type of bottom	Species of pycnogonids
	1906	° ′ ″	° ′ ″	*Fathoms*			
4780	June 7	52 01	174 39	1,046	35.9	gy. m., s., p.	*Nymphon dissimilis.*
4803	June 24	46 42	151 45	229	35.9	crs. p., bk. s.	*Phoxichilidium ungellatum, horribilis. Colossendeis dofleini, Pycnogonum ungellatum.*
4804	June 24	46 42	151 47	229	35.9	crs. p., bk. s.	*Colossendeis dofleini, Pycnogonum ungellatum.*
4809	July 16	41 18	140 08 40	207–90	35.9	gy. s., p., brk. sh.	*Nymphon japonicum.*
4822	July 21	37 08 10	137 08	130	39.4	gn. m.	*Nymphon elongatum.*
4826	July 21	37 25	137 32	114	42.5	fn. gy. s., bk. sp.	*Nymphon japonicum, albatrossi, Phoxichilidium ungellatum.*
4829	July 22	37 20	137 41 30	527–548	32.9	gn. m.	*Nymphon japonicum.*
4833	July 23	36 13 40	135 56 30	79	-------	dk. gy. s., r.	*Nymphon japonicum.*
4842	July 26	36 13	133 27	82	54.6	fn. gn. s., sh.	*Nymphon albatrossi. Phoxichilidium ungellatum.*
4854	July 30	35 54	129 46	335	32.4	gn. m.	*Nymphon uniunguiculatum.*
4891	Aug. 9	32 27	128 34	181	50.2	gy. s., brk. sh., r.	*Phoxichilidium ungellatum.*
4893	Aug. 9	32 32	128 32 50	95–106	55.9	gy. s., brk. sh., p.	*Pycnogonum tenue.*

APPENDIX TABLE 1—Continued

LIST OF STATIONS AT WHICH PYCNOGONIDS WERE COLLECTED BY THE ALBATROSS, 1900 AND 1906—continued

Station No.	Date	Lat. N.	Long. E.	Depth	Temp. °F.	Type of bottom	Species of pycnogonids
	1906	° ′ ″	° ′ ″	*Fathoms*			
4895	Aug. 9	32 33 10	128 32 10	95	-------	gn. s., brk. sh., p.	*Pycnogonum tenue.*
4900	Aug. 10	32 28 50	128 34 40	139	52.9	gy. s., brk. sh.	*Ascorhynchus glabroides.*
4908	Aug. 11	31 40	129 29 40	434	42.9	gy., glob., oz.	*Pallenopsis tydemani.*
4909	Aug. 11	31 38 30	129 27 30	434	-------	gy., glob., oz.	*Nymphon albatrossi.*
4912	Aug. 12	31 39 40	129 20	391	-------	gy. glob., oz.	*Colossendeis japonica, nasuta.*
4913	Aug. 12	31 39 10	129 22 30	391	-------	gy. glob., oz.	*Nymphon albatrossi.*
4915	Aug. 12	31 31	129 25 30	427	-------	gy. glob., oz., brk. sh.	*Nymphon albatrossi; Colossendeis japonica.*
4919	Aug. 13	30 34	129 19 30	440	41.8	glob., oz.	*Nymphon albatrossi.*
4933	Aug. 16	30 59	130 29 50	152	56.0	rky.	*Pycnogonum tenue.*
4934	Aug. 16	30 58 30	130 32	103–152	-------	rky.	*Nymphon japonicum.*
4936	Aug. 16	30 54 40	130 37 30	103	-------	st.	*Nymphon japonicum.*
4958	Aug. 23	32 36 20	132 24 30	405	40.1	gn.-br. m., fn gy. s., for.	*Phoxichilidium ungellatum.*
4960	Aug. 23	32 34	132 24 45	578	38.7	gn.-br. m., fn gy. s., for.	*Nymphon nipponense.*
4965	Aug. 28	33 35 20	135 10 50	191	49.4	dk. gn.-gy. s., sh.	*Nymphon kodanii.*
4967	Aug. 29	33 25 10	135 37 20	244–253	45.9	br. m., s., for.	*Nymphon nipponense.*
4969	Aug. 29	33 23 40	135 33	587	38.9	br. m., s., st.	*Phoxichilidium ungellatum; Colossendeis angusta.*
4970	Aug. 30	33 23 30	135 36 30	500–649	39.1	br. m., bk. s., sh.	*Pallenopsis stylirostre.*
4971	Aug. 30	33 23 30	135 34	649	38.1	br.-gn. m., for.	*Nymphon kodanii.*
4973	Aug. 30	33 24 15	135 30 30	600	38.2	br. m., st.	*Phoxichilidium ungellatum.*
4974	Aug. 31	33 18 10	135 40 50	905	36.6	br.-gn. m., for.	*Colossendeis colossea.*
4975	Aug. 31	33 21 30	135 38 50	545–712	37.5	br. m., p., for.	*Nymphon ohshimai, nipponense; Pallenopsis mollissima, stylirostre; Colossendeis angusta.*
4977	Aug. 31	33 23	135 37 40	544	38.9	br. m., fn. s.	*Nymphon nipponense, kodanii.*
4980	Sept. 1	34 09	137 55	507	39.0	br. m., fn. s., for.	*Nymphon nipponense, Ascorhynchus japonicus, Colossendeis angusta.*
4982	Sept. 19	43	140 10 30	390–428	32.7	gn. m.	*Nymphon longitarse, uniunguiculatum, Colossendeis chitinosa.*
4987	Sept. 20	43 19 20	140 17	59	44.8	rky.	*Decachela discata.*
5018	Sept. 26	46 41 30	143 57 40	100	30.4	br. m., bk. s., p.	*Nymphon hodgsoni.*
5020	Sept. 27	48 32 45	145 07 30	73	30.9	gn. m., s., p.	*Nymphon longitarse, hodgsoni.*
5021	Sept. 27	48 32 30	145 08 45	73	30.9	gn. m., s., p.	*Nymphon longitarse, hodgsoni, Achelia superba, Cilunculus armatus.*
5023	Sept. 27	48 43 30	145 03	75	30.9	s., p.	*Nymphon longitarse, hodgsoni, elongatum.*
5024	Sept. 27	48 43 10	144 59 30	67	30.9	s., p.	*Nymphon longitarse, braschnikowi.*
5025	Sept. 27	48 43 30	144 56 45	52	31.7	p.	*Nymphon longitarse, hodgsoni braschnikowi.*
5026	Sept. 28	48 36 10	145 17 30	119	30.4	gn. m., bk. s., g.	*Nymphon braschnikowi.*
5029	Sept. 28	48 22 30	145 43 30	440	35.3	bk. s., g.	*Colossendeis dofleini.*
5032	Sept. 30	44 05	145 30	300	34.9	br. m.,fn. bk. s., g.	*Ascorhynchus japonicus.*
5037	Oct. 2	42 02 40	142 33 20	175–349	37.9		*Nymphon longitarse, braschnikowi, Achelia borealis, Cilunculus armatus.*
5038	Oct. 2	42 02 40	142 36	175	37.1	fn. bk. s., br. m., brk. sh.	*Nymphon braschnikowi.*
5040	Oct. 3	42 14 20	142	140–269	41.1	gn. m.	*Nymphon longitarse.*
5043	Oct. 3	42 10 20	142 15 20	330	37.9	br. m., fn. bk. s., co., s.	*Colossendeis angusta.*

APPENDIX TABLE 1—Continued

LIST OF STATIONS AT WHICH PYCNOGONIDS WERE COLLECTED BY THE ALBATROSS, 1900 AND 1906—continued

Station No.	Date	Lat. N.	Long. E.	Depth	Temp. °F.	Type of bottom	Species of pycnogonids
	1906	° ′ ″	° ′ ″	*Fathoms*			
5050	Oct. 10	38 11 30	142 08	266	37.9	dk. gy. s., brk. sh., for.	*Nymphon gunteri, heterospinum; Colossendeis angusta*
5075	Oct. 15	34 38 15	138 16 15	22	75.0	fne. br. s.	*Anoplodactylus* sp.
5078	Oct. 19	34 12 20	138 02 30	475–514	38.9	fn. gy. s., glob.	*Anoplodactylus* sp.
5079	Oct. 19	34 15	138	475–505	39.1	p.	*Phoxichilidium ungellatum; Ascorhynchus japonicus; Colossendeis dofleini*
5080	Oct. 19	34 10 30	138 40	505	38.7	fn. gy. s., glob.	*Nymphon micropedes; Pallenopsis mollissima; Phoxichilidium ungellatum*
5082	Oct. 20	34 05	137 59	662	37.7	gn. m., fn. s., glob.	*Ascorhynchus japonicus; Colossendeis colossea*
5083	Oct. 20	34. 04. 20	137 57 30	624	38.1	fne. gy. s., glob.	*Ammothella profunda; Colossendeis angusta, macerrima*
5084	Oct. 20	34	137 49 40	918	36.8	gn. m., fn. s., glob	*Ascorhynchus japonicus*
5085	Oct. 23	35 06 45	139 19 45	622	37.8	gn. m., fne. bk. s.	*Nymphon benthos*
5094	Oct. 26	35 04 42	139 38 20	88	54.8	bk. s., brk. sh.	*Ascorhynchus japonicus*

Shore collections:

June 23 Milne Bay, Simushiru—*Achelia pribilofensis, Achelia* sp.; *Pycnogonum buticulosum.*

July 3 Hakodate—*Callipallene dubiosa.*

APPENDIX TABLE 2

LOCALITIES AT WHICH PYCNOGONIDS HAVE BEEN COLLECTED IN SIBERIAN WATERS, TAKEN FROM LOSINA-LOSINSKY, 1933

Station No.	Date	Lat. N.	Long. E.	Depth	Temp.	Type of bottom	Species of pycnogonids
		Peter the Great Bay and vicinity					
	1925	° ′ ″	° ′ ″	*Meters*	°*C.*		
243	Aug. 19	bet. Egermeld & Peschani		40			*Nymphon striatum.*
351	Aug. 29	Amur Bay		35.5			*Nymphon striatum.*
27	Sept. 10	bet. Skrilev & Cape Basargin		40		s., sh	*Nymphon striatum.*
48	Sept. 23	Peter the Great Bay		12–16		sa. m	*Nymphon striatum.*
58	Sept. 28	nr. Peter the Great Bay				from sargarsum on stones	*Achelia echinata orientalis.*
64	Oct. 6	42 57.5	131 51.8	7		clean rd. s	*Halosoma derjugini.*
66	Oct. 6	bet. Lavrova & Naumova		20		clean gy. s	*Nymphon striatum.*
	Oct. 12	Peter the Great Bay		50–52		gy. s	*Nymphon striatum.*
"*Vorovsky*"	Nov. 27	44 27.5	140 20				*Nymphon longitarse.*
		[*Tarasov*]					
	1926						
1	Aug. 7	Postava Bay		6.7	18.2	dk. gy. s	*Nymphon striatum.*
6	Aug. 8	Expedition Bay		7.5		gy. m	*Nymphon striatum.*
9	Aug. 10	Novgorod Bay		9	19.2	m	*Nymphon striatum.*
12	Aug. 11	Troitsa Bay		4.4		m	*Nymphon striatum.*
16a	Aug. 11	Postava Bay		2.5–5			*Nymphon striatum.*
25	Aug. 19	Novgorod Bay		7	21.9	m	*Nymphon striatum.*
38	Aug. 27	Novgorod Bay		2.3	22.8	gy. m	*Nymphon striatum.*
40a		Postova Bay		3.6			*Nymphon striatum.*
44	Aug. 31	Novgorod Bay		10.5	21.4		*Nymphon striatum.*
46	Sept. 1	Novgorod Bay		1.25–2	23.4	oysters	*Nymphon striatum.*
47	Sept. 3	Expedition Bay		4	22.1	bk. muddy s	*Nymphon striatum.*
64	Sept. 14	Peter the Great Bay		1.67–2.67			*Nymphon striatum.*
		Kuznetsov, coll.					
	Aug. 11	Patroclus Bay		.5		zoostera	*Lecythorhynchus marginatus.*

		Derjugin, coll.							
208	Sept. 29	42	53.3		131	50	50	----------	gy. muddy s.	*Nymphon striatum.*
	Sept. 29	Usuri Bay					----------	----------	----------	*Nymphon striatum.*
212	Oct. 23	Peter the Great Bay					40	----------	gy. sa. m	*Nymphon striatum.*
		[*Litke*]								
	1929									
8	July 31	Bering Sea					19	.07	----------	*Nymphon brevirostre glaciale.*
14	Aug. 7	71	03		175		60	----------	gy. gn. m	*Nymphon longitarse brevicollis.*
15	Aug. 7	71	04		175		61	----------	gy.-gn. m	*Nymphon longitarse brevicollis, brevirostre glaciale, grossipes.*
18	Aug. 10	71	08	50	175	16	46	----------	fn. p	*Nymphon longitarse brevicollis.*
19	Aug. 10	71	08	40	175	19	46	----------	fn. p	*Nymphon grossipes.*
20	Aug. 10	71	08	30	175	22	45	1.76	fn. p	*Nymphon longitarse brevicollis.*
22	Aug. 11	70	56		175	35	58	1.75	m	*Nymphon longitarse brevicollis, grossipes.*
23	Aug. 12	70	52		175	35	54	----------	m	*Nymphon longitarse brevicollis.*
26	Aug. 18	70	54		175	38	58	----------	m. & p	*Nymphon longitarse brevicollis.*
27	Aug. 20	70	41	5	170	54	54	----------	m. & p	*Nymphon longitarse brevicollis.*
28	Aug. 21	70	37	40	179	09	57.5	----------	m. & p	*Nymphon longitarse brevicollis.*
29	Aug. 22	70	57	30	176	08	58	----------	m. & p	*Nymphon longitarse brevicollis.*
30	Aug. 22	70	37		176	07	68.5	----------	m. & p	*Nymphon longitarse brevicollis.*
31	----------	70	40		175	43	66	1.74	m. & p	*Nymphon brevirostre glaciale.*
33	Aug. 25	70	52		175	12	70	1.75	m	*Nymphon brevirostre glaciale.*
34	Aug. 25	71	05	30	175	11	----------	1.72	p	*Nymphon longitarse brevicollis, brevirostre glaciale.*
38	Aug. 27	71	22		175	12	61.5	----------	p	*Nymphon longitarse brevicollis.*
50	Sept. 7	70	57		175	04	72	0.59	p	*Nymphon longitarse brevicollis.*
51	Sept. 8	70	19	5	174	17	52	0.76	gy.-gn. m	*Nymphon brevirostre glaciale.*
56	Sept. 9	69	04		175	28	52	1.74	m	*Nymphon brevirostre glaciale.*
68	Sept. 17	Bering Sea					16	----------	lava & m	*Nymphon longitarse brevicollis, brevirostre glaciale.*
	Oct. 14	Bering Sea					8–10	----------	s	*Achelia alaskensis, uschakovi, lawrenti, litke.*
72	Oct. 19	Bering Sea, Providence Bay					8–5	----------	muddy s	*Phoxichilidium femoratum.*
76	----------	Bering Sea					20	----------	m	*Nymphon longitarse brevicollis, brevirostre glaciale.*

APPENDIX TABLE 2—Continued

LOCALITIES AT WHICH PYCNOGONIDS HAVE BEEN COLLECTED IN SIBERIAN WATERS, TAKEN FROM LOSINA-LOSINSKY, 1933—continued

Station No.	Date	Lat. N.	Long. E.	Depth	Temp.	Type of bottom	Species of pycnogonids
		Красный Якут					
		Okhotsk Sea					
	1929	° ′ ″	° ′ ″	*Meters*	°*C.*		
133/18		54 33	142 40	67	1.5	p. & s	*Achelia litke intermedia.*
		Japanese Sea					
198/98		Soviet Harbor		8		laminarians	*Nymphon striatum.*
299/14		Novik Bank		1.5		st	*Achelia gracilipes borealis.*
238/13		Kastri Bay		12		m. & st	*Nymphon striatum.*
253/28		Kastri Bay		10		m. & st	*Nymphon striatum.*
270/45		Saman Bay		2		zoostera, st., oz	*Achelia gracilipes borealis.*
280/55		bet. Kastri & Kazakevicha Bay		9		m. & st	*Nymphon striatum.*
284/59	Aug.					zoostera	*Achelia gracilipes borealis.*
307/82		Kastri Bay		9.5		gy. m	*Nymphon striatum.*
330/105		Kastri Bay		14–18		m. & g	*Nymphon striatum.*
342/9		Olga Bay		7–9		g	*Nymphon striatum.*
350/17		St. Vladimir Bay		11		g., st	*Nymphon striatum.*
358/25		St. Vladimir Bay		72–80		p. & bryozoans	*Nymphon hodgsoni.*
359/26		St. Vladimir Bay		36–38		p	*Nymphon striatum.*
364/31		Olga Bay		100		p	*Nymphon hodgsoni.*
369/36		Srednyaya Bay		35		g	*Nymphon striatum.*
		[*Steinberg*]					
	1930						
1	Sept. 19	Peter the Great Bay		60		m. & s	*Nymphon striatum.*
3	Aug. 29	nr. Askold Id		75		m	*Nymphon longitarse*

8	Sept. 25	Peter the Great Bay		58		s	*Nymphon striatum.*
9	Sept. 25	Peter the Great Bay		58		st	*Nymphon striatum.*
9	Sept. 19	C. Gamova		79		s	*Nymphon longitarse.*
11	Sept. 25	Peter the Great Bay		67		s	*Nymphon striatum.*
12	Sept. 19	C. Gamova		190		m. & s	*Nymphon longitarse.*
13	Sept. 25	Furugelma Id		130		m	*Achelia borealis japonica.*
		Красный Якут					
	1930						
122/7c	July 17	48 58 2	140 35 3	75	0.6–0.8		*Pycnosoma strongylocentroti.*
133/18	July 31	54 33	142 40	67	1.5	p. & s	*Nymphon grossipes.*
134/19	Aug. 1	56 08	144 55	287	1.16	p. & m	*Nymphon grossipes.*
135/20	Aug. 1	56 45	145 50	218	1.5	sa. m	*Nymphon grossipes.*
139/24	Aug. 3	59 05	140 19 5	96	0.94	p. & sa. m	*Nymphon longitarse.*
389/56	Sept. 27	C. Povorotni (nr. 42°40′ 133°02′)				s	*Nymphon hodgsoni.*
	Nov. 6	43 54 7	135 42 7	107–142		p	*Nymphon longitarse, hodgsoni.*
		Rossinante					
	1931						
250	Oct. 2	Peter the Great Bay, nr. Furugelma Id.		121			*Nymphon longitarse.*
257	Oct. 3	Peter the Great Bay		156–171			*Nymphon longitarse.*
712	Oct. 3	Peter the Great Bay		156–171			*Nymphon hodgsoni.*
271	Oct. 5	Peter the Great Bay		775–955			*Nymphon longitarse.*
274	Oct. 6	Peter the Great Bay		100–155			*Nymphon longitarse.*
283	Oct. 7	Peter the Great Bay		510–545		m	*Nymphon uniunguiculatum.*
30	Oct. 6	Rimsky-Korsakov Id		123–150			*Nymphon longitarse.*
33	Oct. 6	Peter the Great Bay		170–210			*Nymphon longitarse, hodgsoni.*
44	Oct. 20	Amur Bay					*Nymphon striatum.*
	Oct. 31	Vladivostok					*Nymphon hodgsoni.*
	1932						
307	July 12	Peter the Great Bay		1600–1690			*Nymphon longitarse.*
	1931	Okhotsk Sea					*Nymphon grossipes.*
	Sept. 18	Peter the Great Bay, Furugelma Id.		167–340		m	*Nymphon longitarse, uniunguiculatum.*

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